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EVERY THURSDAY
THE COMPUTING WEEKLY
JULY 14-JULY 20 Vol 1 No 19
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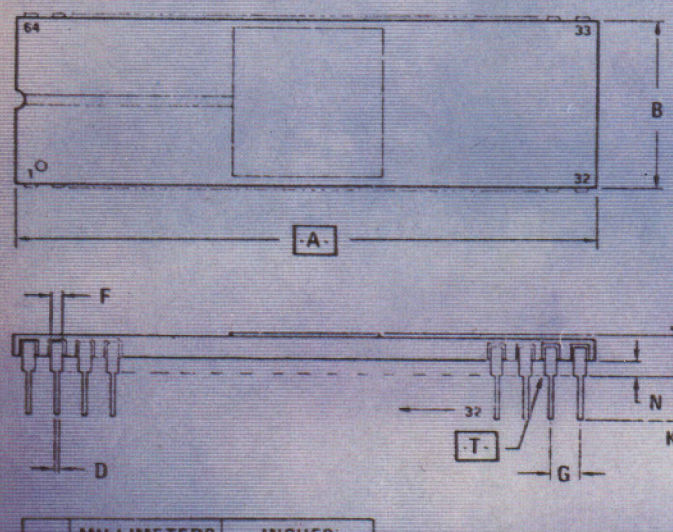
The real 16-bit story, page 42



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Exclusive Pro-Test of Torch Mail Plus

SOUND SERIES
Micropaedia Part 3: Atari, Apple, BBC, TI and Dragon

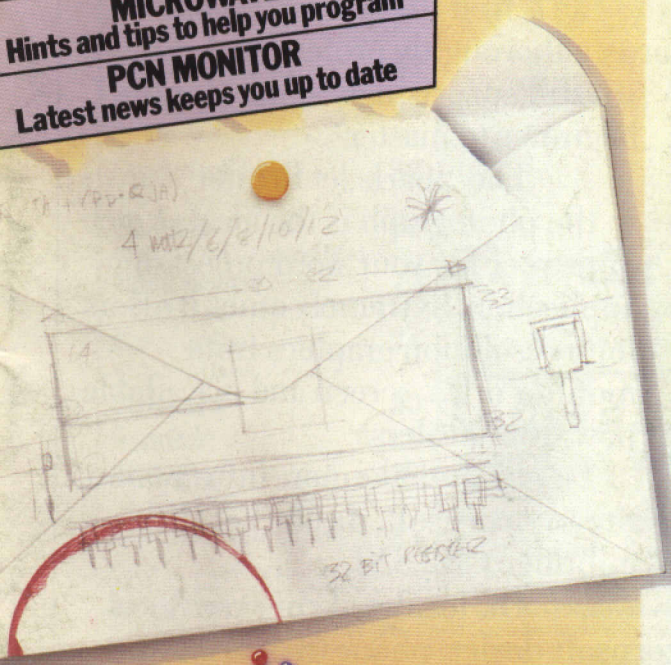
ZX81 WORD POWER
Turn your 81 into a full word-processing system

PCN GAMEPLAY
Commodore 64, Spectrum, Apple and Atari games on trial

EVERY WEEK

MICROWAVES
Hints and tips to help you program

PCN MONITOR
Latest news keeps you up to date



July 14-July 20, 1983 Volume 1 No 19

PCN PRICE RISE

All the best laid plans, and all that . . . we planned to explain the 10p rise in *PCN*'s price last week, when the increase took effect. But we failed. Many apologies.

That extra 10p will enable us to continue to provide 100 pages packed with news, reviews, tips and listings every week. As ever, we'll carry on giving you exclusives every week; we'll carry on giving you full colour. We'll carry on keeping you up to date with the whole spectrum of microcomputing.

PCN now costs more than other microcomputing weeklies. But we give you much more. We give you much more than monthlies at twice the price — *every week*! At 45p, PCN is incredible value. Just read this issue if you need convincing and let us know if you disagree. It's your magazine, after all.

PULL-OUT

Micropaedia

Sound: Part 3

Sound and music on BBC, Apple, Atari, Dragon and TI99/4A

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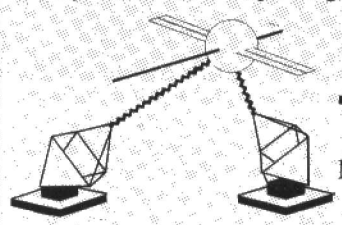

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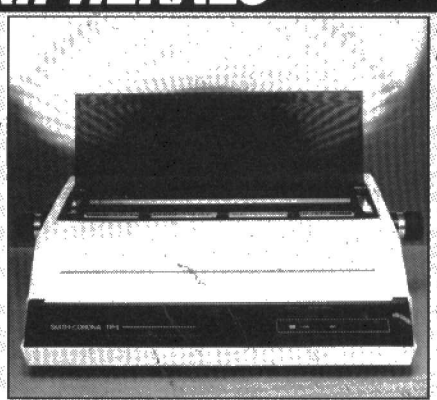

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WORLD EXCLUSIVE

Commodore blitz on software market

By Barry Miles

Something on the scale of an earthquake is about to hit the software industry.

Commodore is moving ahead with a plan that will send shock waves through the ranks of people writing software for its systems. And the repercussions could spread beyond, precipitating a software price war.

The immediate benefits to users are obvious if Commodore's scheme works — the company aims to cut the price of sofware in general by half, and to try to limit the price of business software. The price of cartridges will also tumble. But the ultimate results are impossible to predict.

The president of Commodore's newly formed software division, Sig Hartmann, was in London recently to explain the plan to UK software producers. He also spoke to *PCN*.

The story is this: Commodore sees present prices as too high, and intends to do something about them. It will go in for what Mr Hartmann calls 'Cherry-picking'. The company plans to sign contracts with software houses which will result in Commodore selling the product and promoting it, leaving the software house to design more products, and to modify and improve existing ones.

Commodore will only sign contracts for programs where it expects sales to top 100,000, and with these volumes it will slash prices by half for most software. Mr Hartmann does not intend to have any software for the currently best selling 64 model at more than $99, and wants business software for the more expensive machines to be priced a little over £125!

A maximum of 5 per cent royalty will be payable to the software houses and the likelihood of being able to obtain a large advance royalty will be remote. Mr Hartmann takes the view that if Commodore is prepared to risk holding large stocks of these products, then the producers should take similar risks.

From its research it has extrapolated a figure of $75 as the likely annual software purchase rate of American users. Commodore intends to hold a large percentage of that market.

The cartridge is still relatively expensive, but one of the effects expected as a result of the economies associated with large scale production is that the selling price of the cartridges will be brought down to pocket money levels. And at prices from $10 to $15, cartridge sales are expected to soar.

Gail Wellington, the software manager for Commodore UK, agrees with the forecasts.

The implications for the market and the UK in particular are

Commodore's US base: home of a colossus that aims to bestride the software world.

Users rub hands at prospect of program price war

'I'm all for it. I think there are a lot of small businesses being taken for a ride.'

This was the reaction of Mike Ryan, chairman of the South-East Commodore User Group (ICPUG). He is completely in favour of lower-priced software, both in games and business applications, and doubts the value of some of the support offered with higher-priced utilities and applications.

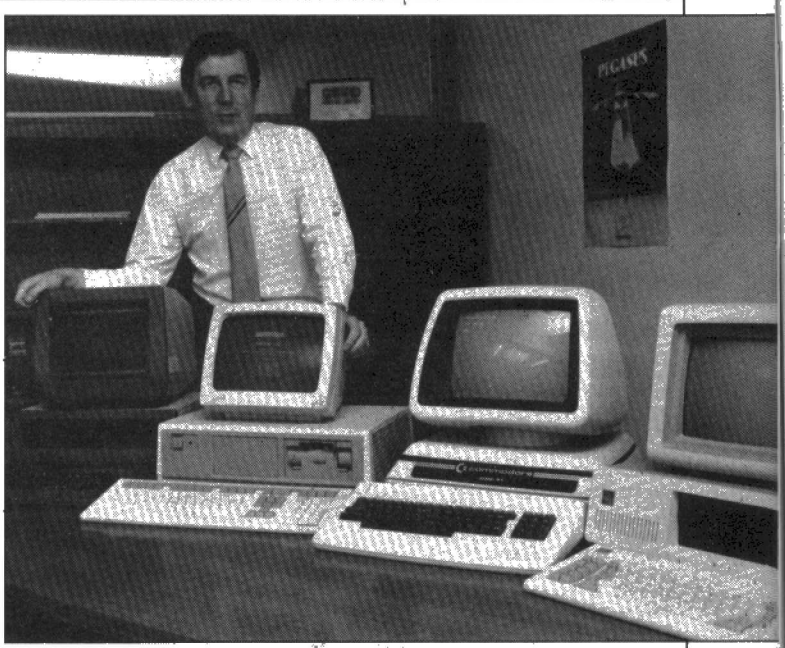
'Dealers claim they have high overheads. For the cost of copying a disk they charge an inordinate sum for software. Ask them about training and they show you the manual and say 'go away and read it'. Ask for support and they consult the manual — if the answer isn't there they refer to the supplier. They may well have overheads but they're nothing to with support or training,' he said.

Mr Ryan is a confirmed believer in the idea of self-help. A shake-out and a contraction in the choice available to users wouldn't necessarily be damaging, he said.

'If the users want something the users will write it and market it, through Commodore if they like. For a one-off they can go to a software house or to other Commodore users.'

High prices, he said, were not only difficult to justify in many cases but were also an invitation to piracy — if prices come down much of the incentive would disappear.

He concluded: 'There has been too much money made too quickly by too many people. It's time for a return to sanity.'



Stuart Whittaker, Pegasus' sales director: 'What kind of support can there be?'

WORLD EXCLUSIVE

interesting to contemplate. Rabbit Software, which markets games only, has confirmed a tremendous rise in its sales following a price reduction from £9.99 to £4.99.

Similarly, there is every sign of a price war in imported products. A successful line of software from US company Abacus was selling there at prices around $29.95. A UK firm, Adamsoft, brought them here under licence and sold them at around £14.95. Very soon a magazine was offering them at £7. Adamsoft subsequently matched these prices. So it seems that the price wars are already under way.

The software houses could now face a dilemma. Should they cast in their lot with Commodore, or go it alone, facing the need to slash their prices to compete? The market as a whole should expand, so the cake will be bigger for everyone, but large volumes will be needed at the slashed profit margins. The games people will have no problem, apart from the need to replace any defective games with new tapes, as they do not have to provide back-up.

For the business software people, the situation is not so simple. You cannot provide installation help and a telephonic advisory service, if you charge only £100 for an accounting package.

Mr Hartmann's approach to this was to say, 'Fine! Firstly the merchandise must be of the highest possible quality, and secondly you charge for service, at an appropriate hourly rate. Alternatively you give the software away, as dealers, in order to sell the machine.'

Some dealers had pensive looks after leaving the meetings but contracts are thought to have already been signed.

The implications for the industry could be substantial. Users should buy microcomputers for what they will do, not for what they are, so well-informed buyers will increasingly be looking for the cheapest combination of both software and hardware which will do what they want.

With dozens of microcomputing magazines on sale in this country, it seems the number of well informed customers should be on the increase. Thus it is possible the software price war will spread across the industry, and not be restricted to Commodore products. Microsoft has recently reduced its wordprocessing package to around £100, for instance.

But one thing's for sure, this is good news for users, at least in the short run. Long-term implications are not so clear

Usually in a price war, customers do well for a while, and then,

Gail Wellington, Commodore UK software products manager: agrees with US forecasts.

when the war has culled the appropriate number of casualties, the survivors bring the prices back up to what they were, or above, and the net result is that the range of choice has been reduced. Perhaps with software the circumstances are different, because the marginal cost of producing each unit is so low: it is not very expensive to produce a disk and a manual, and the cost of cassettes is trivial.

All really depends on whether sales expand dramatically as a result of this policy, or whether it will be a cut-throat war over the shares of an existing market.

Mr Hartmann was very surprised at the high prices of UK-produced software, although he conceded that it was among the best in the world. He said that we had programs selling at £400 which he would have expected to see at $125 in the United States, a price difference he attributed to greed.

Eventually Mr Hartmann expects to sell three million packages a month world-wide, plans are that five million Americans will own Commodore computers by the end of 1983, though this is a bit on the breathtaking side, and $500,000,000 of software sales are anticipated in two years' time.

It is clear that Commodore has been influenced by the few large buyers it has who take 50 per cent of Commodore's hardware sales in the US. They want to get all their major supplies from Commodore, so they are willing to sign bulk software purchase contracts with the corporation.

The cost to Commodore of selecting the wrong products for such a massive investment will be prodigious.

The user can afford to sit back and watch the prices tumble as they have for computers, and reflect on the fact that competition means lower prices and more facilities.

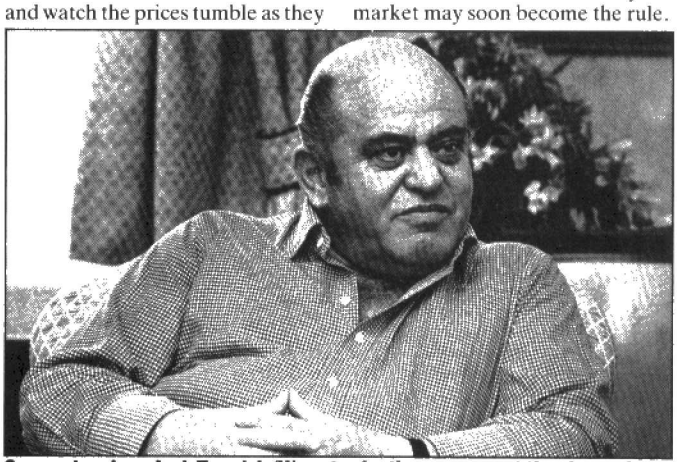
The producers will be reflecting wryly that the days of being able to sell any old thing to a willing market at high prices are over, and that the only time you can sell rubbish is in the first few months of a new machine's life, when there is a dearth of software.

In the case of Commodore, the new machines find their way into the hands of software producers while the machines themselves are in the development stage.

Commodore has always been perceived as a hardware microcomputer company. Run by Jack Tramiel, in a very enterpreneurial and pragmatic fashion, it has survived and expanded in a very competitive market.

Jack Tramiel is a nimble operator, given to remarks like 'We cater for masses not the classes'. For many years it was cause for comment that this international corporation did not seem interested in the software market, except insofar as the software sells hardware.

This clearly, has changed; and as a result it looks as if a buyer's market may soon become the rule.



Commodore boss Jack Tramiel: 'We cater for the masses, not the classes.'

Specialists scoff at plans

Commodore's plans have been given a firm thumbs down by the people who write and sell business and games software for Commodore systems.

Their comments last week ranged from 'They havent't got a prayer' to 'I'll just carry on doing what I'm doing.' Nobody expects to go out of business in a hurry, and most thought the scheme was a non-starter.

If it does get off the ground, opinion is split as to what the results will be.

'A price war might develop,' said Llamasoft's Jeff Minter, 'but it won't affect people like me producing quality software at cheap prices. It might affect the small outfits who are basically just copying arcade games.'

Imagine was even more devil-may care. 'If anybody wants to drop prices to silly levels that's up to them,' said Dave Lawson. 'Software sells on software content, not price,' he added firmly.

'A lot of people might get fired up with enthusiasm and in games software there is potential for the scheme,' said Stuart Whittaker of Pegasus. In business applications, he added: 'You could do it with simple spreadsheets, databases and a word processing packages, but not with specialised applications.

In general, the reaction was that if Commodore's plan was going to create problems they would be somebody else's problems. But there was also the common view that Commodore had the biggest problem of them all.

'Commodore has never been that good at producing software,' said Terry Grant of Rabbit. This was echoed by Henry Smithson at Audiogenic: 'The software side has always been very disorganised.

'One can regard cartridges as hardware in the way they're manufactured, and Commodore is in a very good position for that. If they bring cartridges down to the prices they are talking about we couldn't compete with that.'

But he added: 'If Commodore produces cheap cartridges we'll just stick to cassettes—I think there will always be a market for £7 cassettes as opposed to £15 cartridges.'

Mr Lawson was more outspoken: 'Commodore wants to shape the market and they don't have a chance, there are too many other people involved.'

In short, the software houses expect a state of more or less peaceful co-existence to continue, and none of the ones interviewed by *PCN* was giving a second thought to tying its fortunes directly to Commodore. But Mr Whittaker perceives a dangerous trend developing.

'I've a lot of concern about what's happening in the business software market. At the Comsumer Electronics Show in Chicago you could see complete systems coming out at $600 — how the hell is the average dealer going to make any money out of that?

'People want a totally supported package at a realistic price — what kind of support can there be at those price levels?'

CheaP/M

The war of words between Digital Research (DRI) and Microsoft has moved into the area where it might actually do you some good — prices.

Xitan Systems, one of DRI's main distributors in the UK, is passing on price cuts across the board on the US software company's products. The cuts work out at about nine per cent.

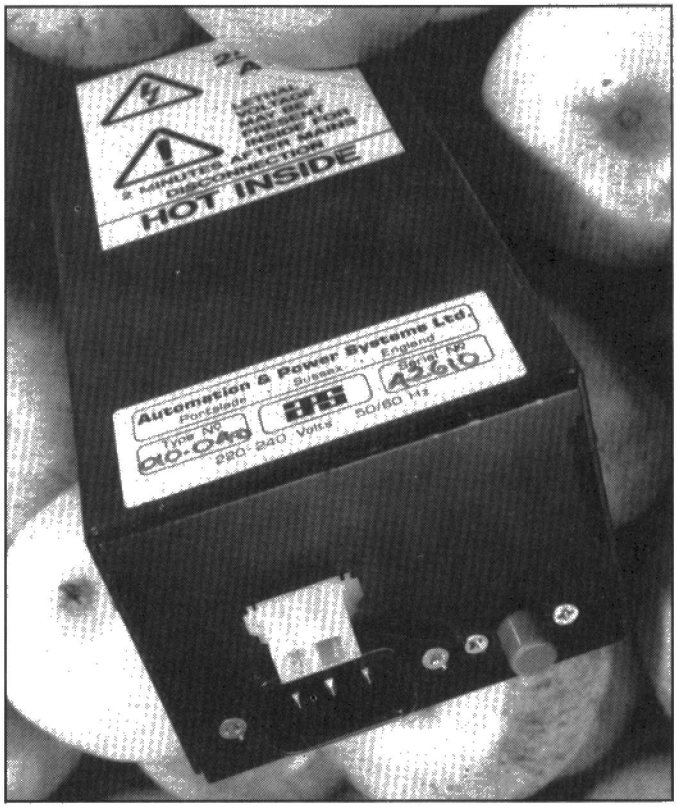
Geoff Lynch of Xitan said that the reductions come from DRI but that Xitan has been putting pressure on the company for some time to bring its European prices down. The cut corresponds almost exactly to a surcharge that DRI has levied on European users since it first started to sell its software here.

This surcharge has now been removed since start-up costs have been covered. According to Mr Lynch the move is not a further strike by DRI against its great rival Microsoft, and as a distributor of its products also he said he didn't expect it to respond.

The difference that the price cuts will make to you is fairly constant. CBasic comes down from £106 to £97; CP/M+, having been £248, will now cost £226; Concurrent CP/M moves to the same price, £226; and CP/M86 for the IBM PC drops from £43 to £39.

All DRI's operating systems, languages and programming tools will be affected and some of the newer products, in the front line in the battle with Microsoft, will look more attractive as a result. These include the C compiler, Personal Basic (reviewed in *PCN, issue 18*), and various items of graphics software.

Xitan Systems is on 0703 334711.



Apple allowed mobility

Mobile Apples are now a possibility.

At £322, the APS 10.040 power supply unit will free you from the mains. It allows an Apple to be run off a standard 12 volt car battery.

And if you want to use it in the office, the Apple's battery will be triple charged to take over in case of power cuts. The unit is protected against surges and was developed by Automation & Power Systems Ltd of Portslade, Brighton. It is available on 0273-420196.

Commodores get 3in disk

Three inch floppy disk drives will soon be available for the Commodore micro series.

Automation and Power Systems is promising a 3in dual unit for around £400. The unit is said to be plug-compatible with the 8032, Vic 20, Commodore 64 and the new 700 series. It will run both CP/M and Pet DOS. The microfloppy disks are housed in rigid plastic casings with a sliding shutter which automatically closes when they are removed.

This method is designed to protect the media from the dirty world which has easy access to the unprotected media on 5.25 or 8in floppies. Diskette capacity is 250K per surface in double density format and 125K in single density.

APS expects the drives to be available in September when the first shipment is expected to arrive. It can be contacted on Brighton (0273) 420196.

Pal for 64

When you tire of Basic on your Commodore 64 you can always try your hand at assembly language. And to help Kobra has launched Personal Assembly Language at £79.35.

Occupying just 4K of memory it has been designed to fit in with the Basic environment and Kobra is claiming that the transition from Basic to assembler should be relatively easy, even for those new to programming.

The language can only be used with a 1541 disk drive. The disk also contains a machine code monitor.

PAL is a two-pass assembler.

Facilities claimed for the language include full labelling, allocation of opcodes and operands, and a wide range of addressing modes. With the expression evaluator you can use complex expressions with a wide set of operators and operand formats. Terms can be decimal, hexidecimal, binary, ASCII, labels or expressions. Kobra is on 04912-2512.

Gameplay duo for Lynx

Seventeen new games are on the way for owners of Lynx, ZX81, Dragon, Vic 20, Commodore 64 and Atari micros. The offerings, from Romik, for the Lynx are Power Blaster and 3-D Monster Chase, both at £9.99, while the games for the remaining micros consist of adventure and arcade games, with no price details available yet.

Games written for Camputers' Lynx will be marketed simultaneously by both companies as part of a long term plan, and should therefore be widely available since Romik has about 1,000 outlets throughout the UK.

APL enhances speed

APL specialist, MicroAPL Limited has souped up its software for its own 68000 micro.

The major changes are enhancements to its APL interpreter so that it runs two to five times faster. Improvements to some functions have resulted in speed gains of up to 200 times, says the company.

APL has a small but very keen following and MicroAPL is out to attract users to its system with claims that it now runs three times faster than any other APL on a microcomputer.

David Eastwood goes even as far as to claim, 'our high quality software gives MicroAPL customers a level of performance and facilities that dramatically exceed even mainframe APL versions'.

The new system software has been extended to include support for networking standards such as Ethernet.

Mainframe compatibility is very much the theme of MicroAPL's next developments. These include improvements in existing Bisync and SNA communications and support for the latest high-quality colour graphics.

Micro fun run

The race is on in a marathon to find the most reliable 16-bit micro.

Micro Networks, distributor of the Samurai, has thrown down the gauntlet to anybody who can put a 16-bit micro in the field with twin floppy disk drives and Pascal.

The Marathon will be refereed by *Personal Computer News* and *Which Computer?* It will kick off with all the big guns meeting at the World Trade Centre in London on August 10.

At 12pm that day machines will be switched on and they'll byte away continuously 24 hours a day, for seven days until August 17 at 12pm, when survivors will grind to a halt.

Each company has to produce two machines and will be provided with a piece of source code of a Pascal program which they must leave running until the finishing line is crossed.

At the end of the week impartial adjudicators will check the number of times each machine performed the program, the number of times it broke down, and how long it took to re-start. Taking a number of factors into account they will then announce the results.

So far, DRG with a Sirius, Apple with a Lisa, Sage with a Sage II and of course, the host Micro Networks with the Samurai have taken up the challenge.

For further information contact Jay Hurwitz, tel: 01-602 7405.

Osborne on the town

By Sandra Grandison

'We will support the winner,' says the father of portable computing Adam Osborne. 'We are the ultimate whores when it comes to that kind of thing.'

Mr Osborne, on a two-day flying visit to London last week, passed this comment on the Digital Research/Microsoft struggle for supremacy. But it reveals a pragmatism that colours much of what he has to say about himself, his company, and the portable business in general. In the course of an exclusive interview with *PCN* he looked back, looked into the future, and had plenty to say about the present.

Adam Osborne was a well-respected computer journalist until he saw which way the wind was blowing, put his money where his mouth was, and produced the Osborne 1.

Since then he has never looked back. His company has grown from strength to strength, and with the latest addition to his product line — the Executive — it looks as though better things are to come.

But faced with stiff competition from machines like Compaq, Corona and Kaypro — Mr Osborne will have to keep on his toes to stay ahead.

'Compaq we see as a very long term threat,' he told *PCN*. 'They seem to have rather a solid strategy and organisation. Kaypro frankly don't — they're a temporary nuisance in America. Outside America they don't sell particularly well and are selling a number of machines using very short range tactics.

'What they're doing is taking a tiny margin for themselves and offering dealers a very small margin, and that way getting a much lower retail price.'

He added: 'What then happens is that unknowledgeable users are buying the machine, but they have an inferior dealer network. It's only a question of time before the problems they've created for themselves will come round to haunt them — at which point we don't expect them to be around any more.'

Adam Osborne says he has head-hunted some of the best people in the industry to join his company, and now has a force of 800 employees behind him. For two years the Osborne 1 has been out-selling anything in its league. In the US it's selling relatively slowly because people are buying Executives.

But in Europe the Osborne 1 is selling briskly, and will perhaps outsell the Executive by 2-1.

Users wanting to get hold of the 16-bit option will have to wait until later this year. But Osborne suggests: 'The quickest way to get the 16-bit option, which is the Executive 2, is buy the Executive 1.

'The only difference is the CPU card. It's likely that we'll have such a heavy demand for conversions that it will be some months before we can start shipping 2s.'

With IBM on the verge of launching a new portable, Osborne feels that his company can deliver the goods no matter what happens. 'Put it this way, the market is so large that if IBM is a short way ahead of us we could still be successful'.

Adam Osborne marked his visit to London by launching the Executive. Selling at £1995 plus VAT, it is a major improvement on the old Osborne 1 with a 7in amber display, double density disk drives holding 200K per disk, CP/M+ and UCSD-p operating systems as added features. And to round up the package £2,000 worth software is thrown in *(PCN, Issue 8).*

He sees machines like Epson's HX20 and Tandy's Model 100 as 'transition' products, and he dismisses them as 'incapable of doing serious work'. But they point to elements that future Osborne machines could include — integrated printers, larger flat screens, and 3in floppies.

With the home market growing rapidly Osborne still has no plans for moving in that direction. 'The long-term future of the Osborne is in business,' he said. 'The home and entertainment market is looking for less expensive machines with fewer capabilities. However, Osborne has stuck by his philosophy of giving the user a complete package.

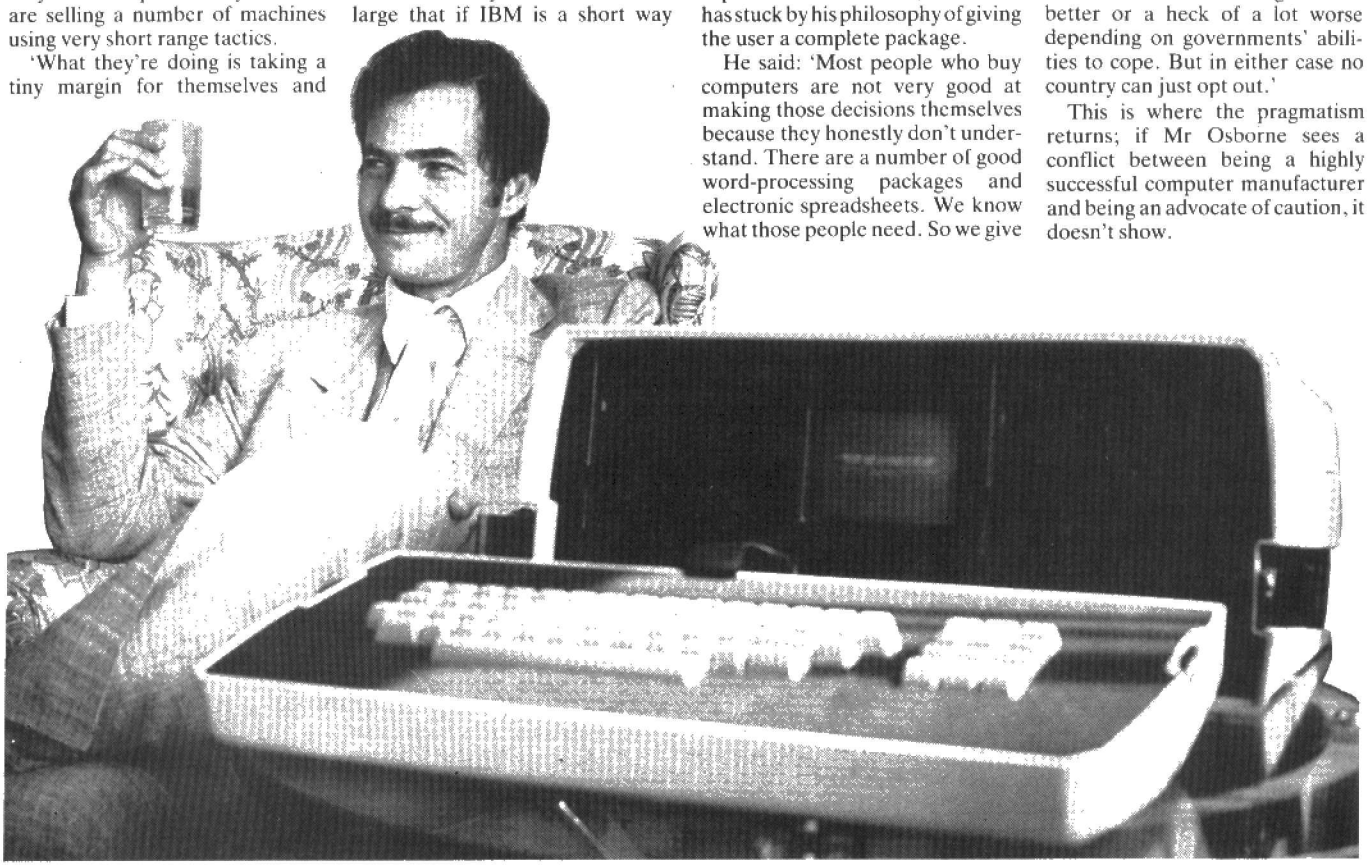
He said: 'Most people who buy computers are not very good at making those decisions themselves because they honestly don't understand. There are a number of good word-processing packages and electronic spreadsheets. We know what those people need. So we give it to them and make the decisions for them and that makes the purchase so much easier.'

Mr Osborne says he is not motivated by money. He has a house in California, a sailing boat, and plans to buy an apartment in Hawaii.

Although he's reached the ultimate heights as a businessman, he still has one burning ambition — to be a novelist. He is just finishing a novel in the style of Brave New World or 1984, but in his book he deals with the social aspects of technology rather than technology itself.

'The technology is here,' he said. 'It could make our lives a great deal better or a heck of a lot worse depending on governments' abilities to cope. But in either case no country can just opt out.'

This is where the pragmatism returns; if Mr Osborne sees a conflict between being a highly successful computer manufacturer and being an advocate of caution, it doesn't show.



Prism steals the show

By Ralph Bancroft

As London sweltered Britain's micro companies were showing their wares in the relative coolness of the Barbican Exhibition Centre. They had gathered at Microtrade to tempt retailers into stocking up with the latest goodies.

Apart from the launch of the new Portico and Sharp machines, the real scene stealer was Prism Microproducts. In addition to showing its new directly coupled modems it was also demonstrating a revolutionary way of buying software.

The company has secured exclusive UK rights to the Romox software system that was demonstrated at the Consumer Electronics Show in Chicago. At the heart of it is the Romox Programming Terminal (actually a Compaq computer with the keyboard removed).

The idea is that the shop rents this unit, which has slots that take a variety of cartridges. The user comes along, plugs in a blank cartridge and loads into it the software of their choice.

A hard disk in the unit is regularly updated (by telephone) so that all the latest games and popular programs are available. When you get fed up with the program you can take the cartridge back and reload it with another program on the list.

Prism has yet to work out the prices it will charge, but they are likely to be around £7 or £8 for a blank cartridge and £4 or £5 for the programs.

The scheme will be tried out in the Birmingham area in a few months' time and should be available across the rest of the country in the new year. The system will work with the TI 99/4A, Vic 20, Commodore 64, Atari micros and games machines. The BBC and Spectrum may also be included.

As for Prism's modems, they are as predicted in *PCN*'s full length preview (*PCN*, issue 10). The basic model, the 1000, costs £70 and sits under the telephone. It gives a choice between Prestel operation and micro to micro communication at 1,200 baud, half duplex. The switching in the latter mode has to be done manually. Users wanting the switching in this mode to be done under software control will have to purchase the 2000, which costs £85.

Terminal software for the modems comes separately. For the BBC it costs £15 on cassette or £20 on ROM. The software is different from that provided by Micronet, and includes a number of improvements. For the Apple there are two versions. One allows connection through the games paddle port and costs £30. The other comes complete with a plug-in card, and allows other communications devices to be attached. It costs £50.

The software/hardware packages for Commodore machines are more expensive as they include graphics chips to provide the full Prestel character set. Other machines for which software is provided include the RML 380Z and the Tandy Models I and III.

Micro manufacturers who were drawing attention to themselves at the show included Oric, which announced price cuts in its machines. The 16K model now costs £99.95 for just the micro and the 48K version has been reduced to £139.95. Purchasers will also get a £40 voucher with the machine. This can be put towards the cost of Oric's four colour printer.

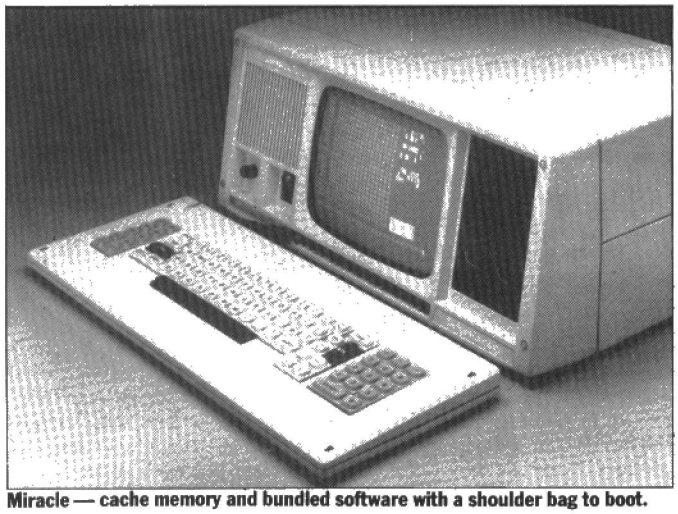
The company was saying that its other peripherals, the modem and the disk drive, will be out in September.

The Jupiter Ace was to be seen sporting a new case. It was designed for the American market, but the company is now intending to use it in the UK as a replacement for the very flimsy case in use at the moment. You can now buy the Ace complete with a 64K RAMpack as standard for £89.95 (in the old case) or £99.95 for the new cased version.

Outshining the Jupiter Ace was the robot arm that was squatting on the corner of the stand. It is made by Cyber Robotics, costs £650 and can be controlled by the Ace. Another robot giving demonstrations was the BBC Buggy from Economatics, which was composing music by driving over bar codes.

There was a confusing array of software to be seen, much of it new. Microsoftware was demonstrating spreadsheet programs for the Vic20 and Commodore 64. Practicalc comes on either tape or disk, and prices start at £29.95. The software was written by the US company, Computer Software Associates, which is planning to bring out complementary packages called Practiword and Practifile in a few months and Practibase and Practiplot in the new year.

On a slightly different theme, Iansyst was allowing visitors to try out its new typing skills package that runs on a variety of machines. The aim of the program is to teach the user how to use the keyboard of his/her micro properly ljml-.;plsd.



Miracle — cache memory and bundled software with a shoulder bag to boot.

Portico's Miracle—it's in the bag

Latest in the long line of British-built CP/M machines is the Miracle from Portico Technology. It's a heavy (28lb) business portable complete with a shoulder bag.

Inside there's a 10in screen, twin 400K-floppies and a full size detached keyboard. The computer has a Z80 with 64K RAM plus a 64K RAM disk cache memory. Software is based on CP/M 2.2, and the Miracle comes with *The Guide* from Decision Systems to make life easy.

Bundled software includes the Micromodeller financial planner, the Iankey typing tutor and the three Chang Labs integrated packages: Memoplan, Fileplan and Profitplan. These provide for word-processing, file handling and spreadsheet processing respectively.

Two of the Miracle's nice points (besides the £1,795 price tag) are 'intelligent disk drives' and its cache memory.

The 64K cache memory is used to keep the most frequently used disk sectors. Portico makes dramatic claims for the resulting speed increase.

Portico is on 01-735 8171.

Sharp corner

Corner-shop micros are on the way in the shape of a Japanese rival to the Commodore 64.

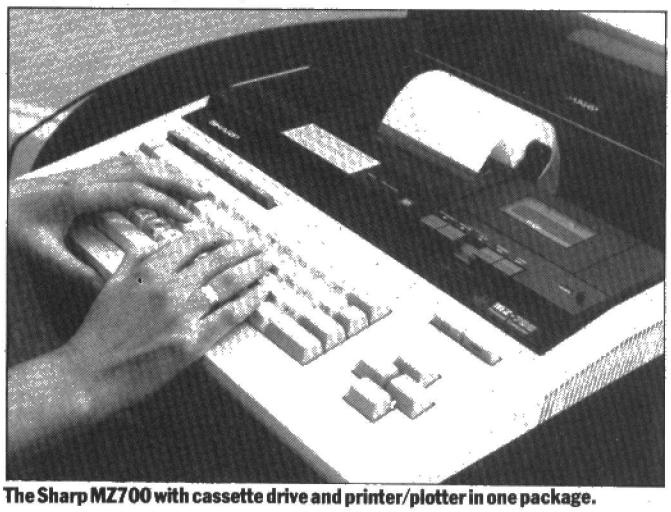
Sharp intends to sell its MZ700 home computer through local electrical goods shops, and its pocket computer range could soon be on sale in newsagents.

The MZ700 was launched in this country last week and will appear in the shops in September, as predicted in *PCN*, issue 4. Sharp is operating training courses for independent retailers at the moment, and by September you may be able to walk round the corner to buy a system rather than making a trip into the town centre.

The MZ700 is a 64K machine based on a Z80 that runs at 3.6MHz. It has 4K video RAM, 4K monitor ROM, and 4K for character generation. One of the device's most prominent features is its collection of 512 characters.

The system, with Basic, will cost £249.95.

You can plug a cassette drive into the unit for £39.95, and a four-colour printer/plotter for £129.95.



The Sharp MZ700 with cassette drive and printer/plotter in one package.

Programmers' agent

A champion of the freelance programmer has arisen in the Suffolk market town of Bury St Edmunds.

Neil Gibson & Co has set up a service to protect young programmers with promising software from being ripped off by unscrupulous software houses. It is putting itself forward as a middleman, like an agent in the music or publishing business.

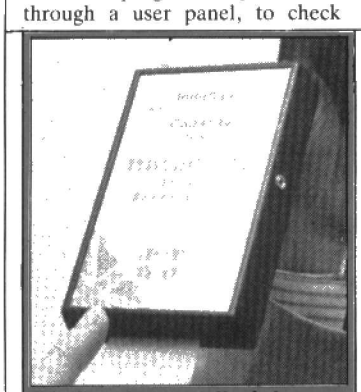
Its service works in stages: first it evaluates programs, by itself or through a user panel, to check whether they are genuine commercial propositions. It may suggest changes, but when it has what it considers to be a viable piece of software it holds a kind of auction among its 37 approved software houses to find the best deal for the author. If the software is of very high quality it may form a marketing company with the programmer to present and sell the program direct to such outlets as WH Smith.

At the moment it deals only in games for Sinclair machines, but later this year it intends to take in Dragon and Vic 20 programs as well.

All agents take a commission; Neil Gibson and Co's is 25 per cent maximum, which it only takes when it has concluded a deal for the programmer — and John Courage, a consultant with the company, stressed: 'We don't require programmers to become commercial experts or take financial risks.'

The head of a leading software producer said the service would only be relevant in the lower reaches of the software industry. But he agreed that exploitation does happen, and that it isn't always obvious immediately: 'It isn't necessarily what they pay the programmer, but how they avoid paying in the future.'

Mr Courage talks of deals he's seen that 'reeked of the most blatant dishonesty'. Many software companies, he says, act responsibly. But others don't, he said, and from them you need protection.



This is not a cassette but a new intelligent printer buffer that will work with any standard Centronics-type printer. The 16K printer buffer, Macrobyte, costs £99.95. A 32K version at £149.95 and a 64K one at £184.95 are also available from Market Logic, on 0432 70456.

Groups form for BBC and Epson users

Two new user groups have opened their doors to users of the Epson HX20 and BBC machines.

Specifically for BBC disk users, the Format 40/80 Disk Club aims to produce a monthly disk for members. The idea is to exchange programs of all kinds including educational and games packages.

For further information contact Peter Hughes, 40/80 Disk Club, c/o The Lending Library, Five Marsh Street, Bristol BS1 4AA.

Terence Ronson, from Ealing, decided to set up the HX20 User Group to bring together a wide spectrum of owners and users of the machine. He said: 'I have had letters from all sorts of people — beginners and experts.

'For instance a lady who uses it for her research work at the Royal Botanical Gardens at Kew, a dentist, and a man who uses it for robotics.'

Mr Ronson says that he will produce lists of programs, information, tips and advice in a monthly newsletter.

Contact Terence Ronson, 25 Sawyers Lawn, Drayton Bridge Road, Ealing W13. Tel: 01-998 1494.

A jamboree of joysticks

Owners of Atari, Commodore 64, Vic 20 and Texas Instruments 99/4A can look forward to a wider choice of joysticks next month.

Consumer Electronics has five new models on the way.

Slik Stik is a compact unit measuring about 3in square with a single fire button and costs £9.95, while Starfighter has a cushioned control mechanism, again with single fire button, for £13.95.

A special Starfighter at £39.95 is available for the Apple IIe and the company will sell an adaptor at £4.95 for earlier Apple models.

Joy Sensor, which looks like a pocket calculator and sounds like something out of Brave New World, is for maze games and has a central slide switch giving you four or eight-way game control for maze or action games. It costs £29.95.

TAC 2 has two fire buttons and appears to be particularly robust, at £18.95.

A drawback for Texas owners is the fact that all these joysticks will need a special £9.95 adaptor sold by the company. Various adaptors are also being sold, including one for left-handed users for £5.45.

A joystick for every occasion from Consumer Electronics.

A joystick extension lead will give you an extra 6ft for £4.45 and a rapid fire adaptor will also be available — price to be decided.

The joysticks should be on sale from major chain stores as well as smaller shops in late August/early September, and Consumer Electronics can be contacted in Manchester on (061) 682 2339.

Pearls of wisdom now in 16 bits

A fresh slant on business software for 16-bit machines is available with the release of Personal Pearl in the UK.

Personal Pearl is an adaptation and extension of a software system that has been steadily if quietly winning friends among business users for some time. It will run under CP/M80, CP/M86 and MSDOS, and you'll need £190 to buy it and 160K on a floppy to use it.

Pearl Software describes it as a self-contained applications generator and database inquiry system. It promises interfaces to word-processing systems and to SuperCalc.

Pearl says its documentation is designed with novices in mind, and to back up this aim it offers training courses and a 'hot-line' telephone support service. Pearl Software is on Bournemouth 20692.

Extra flash from Crash

Is it a bird, is it a plane? No, it's a new software mail order company.

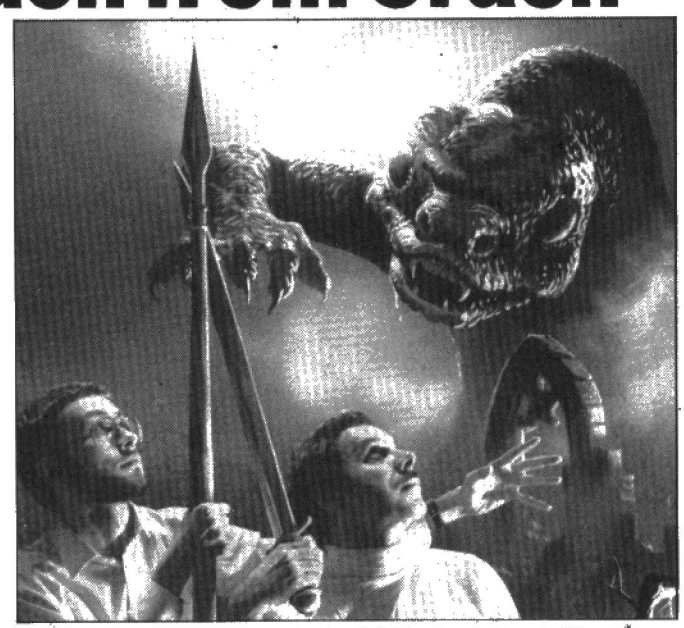
Called Crash Micro Games Action, the company promises to bring showbiz zap to the selling of micro software.

From the un-arcade like environment of Ludlow, in Shropshire, it will be selling a wide range of games software for popular machines starting with the Sinclair Spectrum.

The games come from more than 30 software houses and the first catalogue includes such favourites as Galaxians, Chopper Rescue, Krazy Kong, Frogger and Gridrun.

Crash Micro wants its buyers to know who they are dealing with. 'There's too much "faceless" mail order around,' says Roger Kean, one of the three partners.

The catalogue costs 50p, which can be offset against the cost of the first order. The address to write to is Crash Micro Games Action, Freepost, Ludlow, Shropshire SY8 1BR.



The Crash team poses before a few local sights. Franco Frey (left) and Roger Kean — Oliver Frey is covering the rear.

Thorn looks rosier

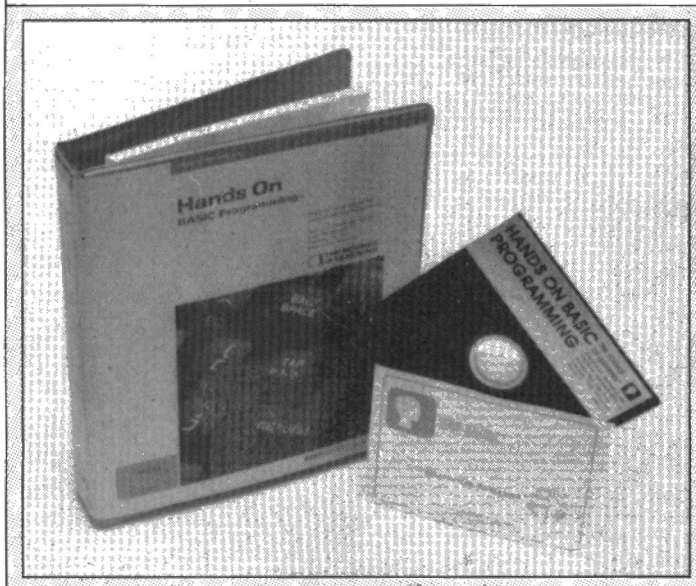
The micro price war is shifting its focus on to software as Thorn EMI slices a fiver or so off the price of all its games to bring everything under the £30 mark.

Although the games giant doesn't issue recommended retail prices for its programs, Mike Dixon of the Home Computer Software division says that most shops stick to the same pricing. So the new set of trade discounts ought to mean that each price category drops down to the one below it.

The two top-priced games, Submarine Commander and Jumbo Jet Pilot for the Atari — both stinging you for £34.95 at the moment — will be down to £29.95 or thereabouts, while at the bottom of the range, cassettes for the Atari will drop from around £15 to around £10.

'Even though all our games except two have always cost under £30, people have tended to think of Thorn software as being expensive because of those two exceptions,' says Mr Dixon. 'So we've broken down the psychological barrier.'

Vic cartridges are going to weigh in at £20 or so, and Submarine Commander is being launched on the Vic, after months spent converting it according to Mr Dixon. 'We reckon there won't be anything else of this size and complexity on a small micro like the Vic,' he says. There's another launch due for the Vic next month, Mediaeval Joust, and a hockey game for the Atari.



Hands on Basic Programming, a 200 — page book produced by Eduware, is a guide to programming techniques. It takes you from computer variables and looping to program planning and de-bugging, and for those wary of numbers, it requires only a basic knowledge of mathematics. Software has been added in order to exercise the skills you learn with it, letting you examine your programs, locate errors and diagnose problems on screen. Hands on Basic Programming costs £56.45 from Pete & Pan Computers on 0706-227011.

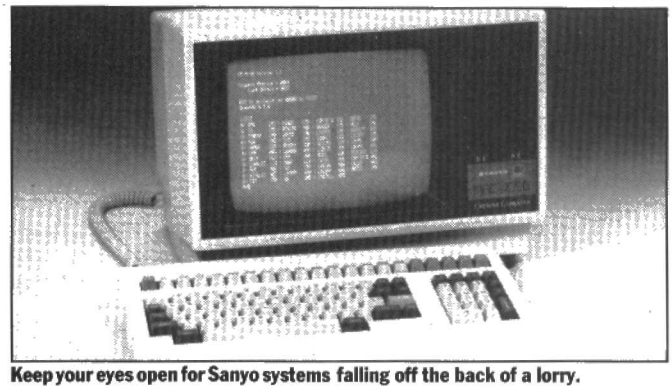
Hard disk back up is now easier

A hard-disk back-up device, the Genie 5+5, which was to have been distributed by Micro Networks (*PCN, Issue 8*) is now in the hands of Advanced Peripherals Products.

The Genie 5+5 is a 5Mb fixed hard disk system with the facility to allow you to slip in a 5Mb removeable hard disk cartridge. The system, from a Californian company called Genie Computer Corporation, is one way to overcome the problem of back-up for hard disks. And with the 5Mb cartridges selling at £90 plus VAT, it allows you to increase capacity cheaply.

Selling at £2,900 plus VAT, the Genie 5+5 comes with an interface and utility package — and is available for the Apple II+, IIe, and IBM PC.

Contact Advanced Peripherals on 01-844 1200.



Keep your eyes open for Sanyo systems falling off the back of a lorry.

Activision arrives in UK

Some of the top arcade games in the US sould get to the UK more quickly with Activision Inc setting up here under its own name.

Activision can point to recent successes that have seen its games claim four of the top 15 places in US charts. These games should now become available more quickly, and to mark the launch of Activision Ltd it has released four new cartridges for Atari and Mattel systems.

Computer Games, Activision's UK distributor under the previous arrangement, will continue to operate the sales and distribution of all Activision cartridges — but Activision will take overall responsibility.

The new games are Happy Trails, a wild west puzzle for £24.95; Seaquest, a Davy Jones' Locker version of Dungeons and Dragons for £29.95; River Raid, a jet fighter mission, also at £29.95; and Spider Fighter at the same price.

Activision's River Raid training the fearless fighter pilots of the future.

Sanyo swiped as micro container heists spread

The outbreak of micro theft that hit Prism Microproducts last week (*PCN, issue 18*) has spread north. The victim this time is Sanyo, which has lost more than £½ million of MBC 4050 desk-top micros.

The systems were in transit from Sanyo's Watford head office to its depot at Warrington when they were stolen from a container lorry parked for the night. Two hundred MBC 4050 systems were on board. The machine retails at £2,817.

Sanyo's computer sales manager Derrick Maddern said that Sanyo will be air-freighting an additional consignment in from Japan to avoid delays for customers. And the company asks you to be sure to deal with Sanyo or Logitek authorised dealers if you're buying an MBC 4050.

Low-cost lists

If you're looking for a low-cost listing printer it may be worth casting an eye over a newly-released £79.35 (inc VAT) offering from Computopia.

The Micromax measures a space-saving 5in by 8in and stands 2.5in high. Unlike some other printers in this range it uses a standard dot matrix technique with a 7 × 5 matrix.

The company claims a full range of interfaces and cables for Vic, BBC, Dragon, Acorn Atom, ZX81 and Spectrum and Research Machines.

A 5.7cm paper roll is housed in the unit, and it can be used up at about 0.7 lines per second. The printer can manage 24 standard or enhanced characters per line with a full character set and pin addressable graphics. *PCN* will soon run a Peripherals Pro-Test on the Micromax. The company can be contacted on 0525-376600.

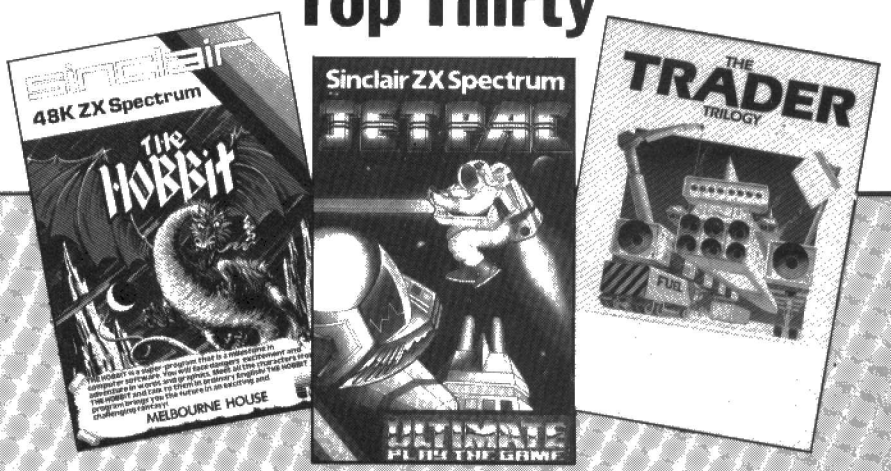
PCN Charts

You've followed the micro charts — now here's the games top 30 compiled from both independent and multiple sources across the nation. They reflect what's happening in high streets in the two weeks up to July 7 and, like the micro charts, do not take account of mail order sales. We'll be keeping them up to date, showing new positions every two weeks, so watch for the changing status of your favourite games.

The micro charts this week show the number of machines sold in the

GAMES

Top Thirty



		GAME TITLE	PUBLISHER	MACHINE	PRICE
▶	1 (1)	The Hobbit	Melbourne House	Spectrum	£14.95
▲	2 (20)	Jet-pac	Ultimate	Spectrum	£5.50
▲	3 (9)	Trader	Quicksilva	Spectrum	£9.95
▶	4 (4)	The King	Microdeal	Dragon	£8.00
▼	5 (2)	Arcadia	Imagine	Spectrum	£5.50
▲	6 (9)	Gridrunner	Llamasoft	Vic 20	£6.00
▼	7 (5)	Transylvanian Tower	R. Shepherd	Spectrum	£6.50
▲	8 (17)	Penetrator	Melbourne House	Spectrum	£6.95
▼	9 (6)	Horace Goes Skiing	Psion	Spectrum	£5.95
▲	10 (24)	Frenzy	Quicksilva	Spectrum	£4.95
▲	11 —	Ah Diddums	Imagine	Spectrum	£5.50
▲	12 (16)	Crazy Kong	Interceptor	Vic 20	£6.00
▲	13 —	Killer gorilla	Micropower	BBC	£6.95
▼	14 (4)	Flight Simulation	Psion	Spectrum	£5.95
▼	15 (7)	Miner 2049er	Big Five	Atari	£28.95
▼	16 (13)	Moon Raider	Micropower	BBC	£6.95
▲	17 (18)	Panic	BugByte	Vic 20	£7.00
▲	18 —	Black hole	Quest	Spectrum	£6.00
▲	19 (21)	Schizoids	Imagine	Spectrum	£6.00
▼	20 (19)	Zaxxon	Datasoft	Atari	£29.90
▲	21 —	Time gate	Quicksilva	Spectrum	£6.95
▼	22 (9)	Attack of the Mutant Camels	Llamasoft	CBM 64	£8.50
▲	23 (27)	Planet of Death	Artic	Spectrum	£6.95
▲	24 —	Everest	Richard Shepherd	Spectrum	£6.50
▲	25 —	Xenon 1	IJK	Oric	£5.50
▲	26 —	3D Combat Zone	Artic	Spectrum	£5.50
▼	27 (25)	Maze Death Race	PSS	Spectrum	£4.95
▲	28 —	PSST	Ultimate	Spectrum	£5.50
▼	29 (7)	Parsec	Texas	TI 99	£25.95
▲	30 —	Knot in 3D	New Generation	Spectrum	£5.50

PCN Charts

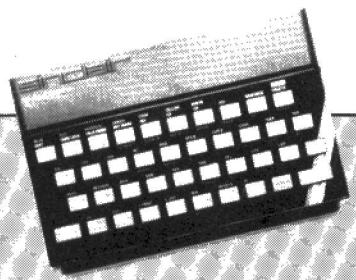
two-week period ending one week before publication date (July 14), so they tell the story in the high street between June 23 to July 7.

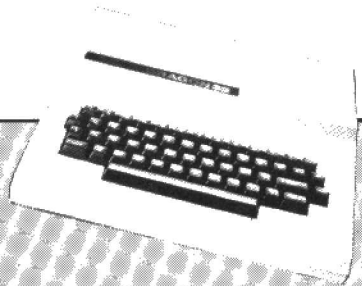
Neither mail order nor deposit-only orders are included and the prices quoted are for the no-frills models and include VAT. Information for the top-selling micros is culled from retailers and dealers throughout the country and, like the games, will be updated every alternate week. Watch the arrows to see how they're doing.

PCN Charts are compiled by MRIB (Computers), London, (01) 408 0250.

HARDWARE

Top Twenty up to £1,000





	MODEL		PRICE	DISTRIBUTOR
►	1 (1)	Spectrum	£99	(SI)
►	2 (2)	Dragon 32	£175	(DR)
▲	3 (5)	BBC B	£399	(AC)
▼	4 (3)	Vic 20	£150	(CO)
▲	5 (6)	Atari 800	£300	(AT)
▼	6 (4)	ZX 81	£40	(SI)
▲	7 (8)	Oric	£99	(OR)
▼	8 (7)	Atari 400	£150	(AT)
▲	9 (13)	CBM 64	£350	(CO)
▲	10 (11)	TI 99/4A	£150	(TI)
▲	11 (12)	Colour Genie	£199	(LO)
▼	12 (9)	Newbrain A	£228	(GR)
▼	13 (10)	Lynx 48	£225	(CA)
▲	14 (16)	Sharp MZ80A	£549	(SH)
►	15 (15)	Apple 11e	£969	(AP)
▲	16 (17)	Sord M5	£190	(SO)
▼	17 (14)	Epson HX20	£472	(EP)
▲	18 (20)	Tandy Colour	£240	(TA)
▲	19 (—)	Sharp PC1500	£169	(SH)
▼	20 (18)	Nascom 3	£549	(LL)

Top Ten over £1,000

►	1 (1)	Sirius 1	£2,754	(ACT)
►	2 (2)	IBM PC	£2,392	(IBM)
▲	3 (6)	Olivetti M20	£2,754	(OL)
▼	4 (3)	Apple 3	£2,780	(AP)
▲	5 (7)	Dec Rainbow	£2,714	(DEC)
▼	6 (4)	Osborne 1	£1,581	(OS)
▲	7 (9)	HP86a	£1,541	(HP)
▲	8 (—)	Epson QX10	£1,700	(EP)
▼	9 (8)	Superbrain	£2,150	(IDS)
▲	10 (—)	Commodore 8096	£1,195	(CO)

AC Acorn Computers. **ACT** — ACT Sirius. **AP** — Apple Computers. **AT** — Atari International. **CA** — Camputers. **CCS** — Colt Computer Systems. **CO** — Commodore. **DEC** — Digital **DR** — Dragon Data. **EP** — Epson. **GR** — Grundy Business. **HP** — Hewlett-Packard. **IBM** — IBM. **IC** — Icarus Computers. **IDS** — Intertec Data Systems **JU** — Jupiter Cantab. **LO** — Lowe Electronics. **LL** — Lucas Logic. **OL** — Olivetti. **OR** — Oric. **OS** — Osborne Computers Corporation. **SH** — Sharp. **SI** — Sinclair. **SO** — Sord. **TA** — Tandy. **TI** — Texas Instruments.

ROUTINE INQUIRIES

Lost in a maze of bits and bytes, trapped in a forest of errors, or bugged by Basic? Whatever your problem, access our HELP function . . . better known as Max Phillips.

Write to: Max Phillips, Routine Inquiries, *Personal Computer News*, VNU, Evelyn House, 62 Oxford Street, London W1A 2HG.

Big beasties

Q I am a Vic 20 owner and want to write machine code programs without using a monitor. Could you tell me where I can obtain a good quality compiler?
Andrew Turton, Nottingham

A Not offhand. Compilers are big, complicated beasties. It is difficult to produce a good quality compiler on any disk-based 8-bit machine, never mind teeny weeny home computers. I dare say that some of the Pet-based compilers could be moved across to an expanded Vic, but I don't know of any one who has done it.

You shouldn't have any problem learning machine code on the Vic. And you don't need to use a monitor. You can buy full assemblers . . . Audiogenic, Commodore and Honeyfold software are the major sources. Honeyfold's Dr Watson course was Pro-Tested in *PCN* issue 7.

Learning assembly language is probably the best thing you could do. Forth is a possible alternative, but you'll end up in machine language soon enough.

Sprites on the TI

Q I am thinking of buying a computer. I'm interested in the Texas TI 99/4A, but I'm not clear on the graphics. Can you give me some information?
Jonathan Creuz, Plymouth, Devon

A The TI does quite well here. It used to be a bit before its time (if you know what I mean!) in that it had hardware graphics ability. Its display is produced by the Texas 9918 chip — a device that provides sprite graphics.

Sprites are predefined shapes (Pac-people, invaders, missiles, cars and so on and so on). Once you've designed a sprite, you can just tell the 9918 to stick it on the screen and move it about. What's more, sprites have 'priorities'. Car sprites can be made to pass behind tree sprites (moving trees? well . . . it's only an example). And the chip will even tell the program if a couple of sprites have collided.

Sprites make it easy to produce smooth, complex animation. The Texas produces games that look much more like arcade and TV games than bit-mapped graphics on machines such as the BBC and Vic. You'll also find similar things available on the 64, Sord M5 and Ataris.

In the TI's case, sprites aren't easily available on the standard machine. You need to buy the Extended Basic cartridge to use them from your own Basic programs. But you'll have trouble finding a spriteless TI cartridge game.

The rest of the TI's graphics aren't much to shout about. You've got 16 colours by 24 rows plus user defined and 32 columns characters. There's a theoretical pixel resolution of 256 × 192 but it ain't easy to get at. But with sprites, who needs resolution?

Disable by Poking

Q I contacted Dragon Data in the hope of finding a way to disable the break key. I was given a series of POKEs that worked while the program was running but not during an INPUT statement. Suddenly, I had a flash of inspiration and found a better way. Just one POKE is needed to completely disable the break key unless it is deliberately required.

I've used PETs at my local college and think that the keys could be disabled in the same way. I see no reason why it shouldn't work on other micros, minis and mainframes. It occurs to me that this idea could be a boon to many commercial programmers and wonder if I could obtain copyright before disclosing it or possibly selling to an interested party.

Can you advise me on how to obtain copyright or alternatively suggest companies that might be interested?
Frank Hart, Moulton, Northants

A POKE is a simple Basic instruction that can be used to do lots of things. With over 80,000 Dragon owners out there, can you be sure that you are the only person to think of this? I would have thought that at least the people who designed the Dragon would already know it.

Copyright on programs is shakey enough. Patents even worse. Individual POKE statements? I doubt it. Even if you come up with a wonderful new mathematical formula or comet, the best you can hope for is to get your name on it.

You may also find the idea a little non-commercial. Professional programmers rarely write in interpreted Basic. Well . . . if they do they won't lose much by having their programs listed. And all the software houses have standard ways of protecting their stuff . . . though techniques vary greatly from machine to machine.

If you do have a good idea then why not let people know? Disabling the break key on the Dragon sounds a good bet for a fiver in *PCN Microwaves*.

Baffled by arithmetics

Q I was using my Oric the other day when I discovered that 7 ↑ 2 gave a result of 49.0000001. I decided to run a short program to print out squares from 1 to 100. In this list, there were no less than 23 errors of this kind.

Other powers gave other errors. Is this a problem with just my Oric? Or is it yet another bug in the Oric's Basic?
Peter Weave, Bristol

A Here's a golden oldie. Didn't you know computers were no good at calculating? Computers do arithmetic like this using a technique called floating point binary. And there are numbers in binary that go on forever and ever, just like there are in our decimal system.

Remember Pi? That's the ratio of the circumference of a circle to its diameter . . . It's a constant — 3 and a bit, or 3.1415926 . . . Pi goes on forever and ever. And a recurring fraction like ⅓ is just .33333333 etc . . . in decimal. Similar things crop up in binary, but the computer has only a finite space to sort them in.

In Microsoft Basic, floating point numbers are stored in five bytes each, so long binary fractions are frequently chopped off or rounded, and errors do occur. Floating point errors are unavoidable. If you're doing serious calculations, you should be aware of this.

That said, the Microsoft Basic in the Oric has a particular problem with its ↑ operator. This is prone to the odd error more frequently than you'd expect. Remember this isn't an Oric bug. It's a 'feature' of Microsoft Basic that's been around for years. Just try PRINT 7 ↑ 2 on any machine still running the ancient interpreter . . . Apple II, Commodore 64 and so on.

Remedy number one is to steer clear of ↑. Use * instead. This is worth it for all but big powers. You'll also find that using multiplication to do squares is around ten times faster than exponentiation.

If you do want to make sure that numbers don't have spurious digits after them, you can round to the nearest whole number with X = INT (X+.5).

And don't ever forget that floating point arithmetic is bound to have errors in it.

Not simple without Simons

Q Regarding the Commodore 64, do you need Simons Basic to control the sprites, sound and more advanced features of the computer? When the Z80 cartridge becomes available, will it be possible to program it in assembly language?
J Westerman, Ambleside, Cumbria

A You don't actually need Simons Basic. It just makes life easier. Microsoft's 8K Basic has no supplied commands for doing machine-specific things like graphics sound, function keys and so on. It's up to manufacturers to add in the relevant bits.

Commodore hasn't done this with the 64 Basic. So the only way you have to access the advanced features is to get at the machine's memory using POKE. You can do everything the 64 could possibly do from its Basic but it'll take a lot of POKEs.

The Z80 cartridge should allow assembly language programming. But it will be interesting to see how Commodore supports the 64.

ROUTINE INQUIRIES

Orics and antiquities

Q I'd like to ask about three micros. My friend has owned a ZX80 since it was launched. What should he do with it . . . upgrade it? Make it into a micro-mouse?

Are any companies producing joystick interfaces for the Oric 1? Are these compatible with existing software? Finally, can you expand the memory of a BBC Model B without fitting a second processor? Would this interfere with any other expansion?

P Clasper,
Durham

A Why should your friend want to do anything with his ZX80? I think it's probably all right just as it is. If he has no other micro and feels a bit left out, he could sell it and put the money towards a Spectrum. But I'd be tempted to keep it . . . it will be valuable one day.

Next, there's plenty of people getting into Oric add-ons. First off the blocks is Pase (061-366 5935) with a twin joystick port for £14.95. MCP (0792-84465) also has an interface, but it's more expensive at £79. But it does include a built-in speech synthesiser.

It is unlikely that anyone will produce interfaces which work with existing software. The trick that some of the Spectrum interfaces pull is to imitate keypresses so that you can set up the joystick to produce the keystrokes needed for the game. I suspect this technique won't be so easy on the Oric.

Nor can you expect current commercial programs to be looking for joysticks since there is no standard interface.

So you could try some of the current choices, and hope that companies will take them up. Or wait around and see what happens. Who knows . . . maybe Oric will produce its own interface!

Finally, the only way people have found to beat the BBC Micro's 32K RAM limit is to start building RAM into the 'Sideways ROM' sockets . . . inconvenient to say the least. The BBC Micro is designed as the first half of a computer . . . running big programs isn't sensible without the second processor.

The final complete machine will be fairly spectacular . . . see a Torch disk pack running for example.

Embellish my brain

Q I received a 32K Newbrain for Christmas and have a few questions. What statement do I use to get input into a program while it is running without having to press New-Line? I can't find it in the manuals but I know it is an INKEY statement on the Spectrum and a GET on the 380Z.

What is the Video-text key on the right of the keyboard for? Lastly, where can I purchase some games for the Newbrain?

Anthony Hodgson,
Clifton, York

A Reading single key presses into a moving program is such a vital ability that there should be an obvious way of doing it. There is . . . it's not in the manuals (even the 'Software technical manual') though all the information you need is. Like most things on the Newbrain, it's a question of doing thing through pompous old IOS. If you understand streams and things, it's all quite easy.

This program reads keypresses, printing a 0 if no key is held down and the key's ASCII code if one is pressed:

```
10 CLOSE#1
20 OPEN#1,6
30 GET# 1,A
40 PRINT A
50 GOTO 30
999 END
```

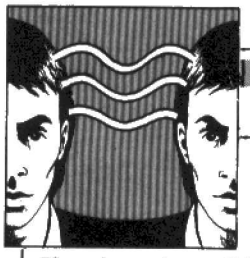
Step-by-step, it first sets up a stream. I picked stream 1 . . . it could have been anything but this was handy. Line 10 closes it . . . you have to make sure it's shut before opening it.

Line 20 opens it and links it to device number 6, the keyboard. From now on, data coming down stream 1 will be from the keyboard. At line 30, the program uses GET (you knew it was GET . . .) to take the next byte (or character) from stream 1 and put it in variable A.

Line 40 prints out A to see what it was and the program loops forever and ever until you press STOP. So that's how you do an INKEY on a Newbrain!

On to the Video-text key. You're right, it doesn't do much at all. If you play with reading keypresses you'll find it does generate a code 0. I seem to remember it being something to do with using the Newbrain as a Viewdata terminal.

As for Newbrain games, try Kuma on 0628-71778. Have fun . . .



MICROWAVES

Scaled a new PEEK in microcomputing? If printed your tip will earn you a fiver.

If you've got something to crow about . . . a bit of magic that'll make the world a better place for micro users, then send it to *PCN* Microwaves—our regular readers' hints and tips page. We'll pay you £5 if we print it. We'll pay you even more if your little gem gets our vote as microwave of the month. Think on . . . and write to Microwaves, *PCN*, 62 Oxford Street, London W1A 2HG.

Unlistable Lynxes

If you're worried about someone listing your Lynx Basic programs, you could try this short protection scheme. Add the following lines to the start of your program:

```
1 CODE21FFFF36002B18
  FB
2 CODE21546922B36222
A762C9
3 CALLLCTN(2)
```

The CODE is a short machine code routine that writes zeros all over the Basic program area. Running the code vectors the LIST routines and cassette output routines to this routine. So after running the program, any attempt to LIST, SAVE or LLIST the program will cause it to be deleted.

When you save the program, save it to auto-run from line 3. The protector will be initialised whenever the program is run. Remember to have a none-protected copy saved for yourself before you try using this.

Chris Cytera,
Bracknell, Berks

Colour Genie locations

Colour Genie users will no doubt be looking for PEEKs and POKEs to try on their new machine. To start with, you can disable the break key with POKE 16396,123 and re-enable it with POKE 16396,201. The keyboard can be switched off with POKE 16405,0 and back again by POKEing 16405 with a 1. This can be used to speed up programs.

To read the keyboard, use PEEK(16420). This location holds the ASCII value of the last key pressed. The function keys have the values 92 to 95 unshifted or 124 to 127 if they are shifted. The code remains in this location even when you let the key go. So if you're looking for single key presses, you might find it helpful to clear it with POKE 16420,0 after you read a code from it.

Finally, many people will by now have discovered a little tip which isn't in the manual. To pause a long listing or output to the screen, just hold down SHIFT and @.

P Billett,
Malmesbury, Wilts

Inverse on the Oric

Inverse characters are available on the Oric by adding 128 to the codes being displayed. For example A has the ASCII code 65. PLOT 10,10,193 (128+65) and you get an 'inverse A'.

However, these characters aren't inverse in the usual sense of the foreground and background colours being swopped round. Instead, the colours change as follows: If the ink or paper colour is red, it will 'inverse' to cyan. Green becomes magenta, yellow becomes blue and white turns black and vice-versa.

For example, a blue A on a white background (PAPER 4: INK 7) will be inversed to a black A on a yellow background.

One way of producing true inverse characters is to alter the character set itself. This is probably more of a novelty than it is practical but you could try this program. It inverses the letters A to Z (that's from addresses 46600 to 46807 in the Oric's memory) but you could alter line 10 to suit.

Run the program a second time to restore the character set.

```
5 REM
  ABCDEFGHIJKLMNOP-
  RSTUVWXYZ
10 FORA =46600 TO 46807
20 POKE A,255−PEEK(A)
30 NEXT A
```

H S Lim
Moss Side, Manchester

Lynx Basic in brief

There are two ways of typing abbreviated keywords on the Lynx . . . either the first few letters followed by a full stop or by pressing ESC and a letter at the same time. Some keywords can be accessed by both methods while others need five or more keystrokes for the full stop form (for example PROT. for PROTECT).

If you don't like what you've got, you can redefine the ESC keywords by POKEing the table at &623A. Each of the 26 bytes in the table contains the token for the appropriate letter. If you know the tokens, you can change them directly. For example POKE &6249,&46 will set ESC/P to PROTECT.

Alternatively, if you don't happen to know the keywords, use POKE &6238+x, PEEK(LCTN(y)−1) where x = 1,2,3 ... 26 for ESC/A to ESC/Z and y is the number of any line containing the particular token you want.

Kym Wilson,
West Byfleet, Surrey

Unknown Oric EDIT

One of the Oric's undocumented commands is EDIT. If you enter EDIT n, the Oric lists the line n and puts the cursor at its beginning.

But this isn't useful just for editing. If you're in HIRES mode, you can use EDIT to look at particular lines of the program. Try using LIST for this and the lines are just scrolled out of the 3-line text window.

Matthew Platts,
Malmesbury, Wilts

Graphically alter your Spectrum

One of the major shortcomings of SCREEN$ on the Spectrum is that it can't normally differentiate between different user-defined graphics. My solution is to alter the system variable CHARS to point tc the user-defined graphics area. When SCREEN$ is used, the Spectrum will check through the RAM-based graphics characters and not the ROM character set.

To do this, POKE 23606,80: POKE 23607,253 (125 if you've got a 16K machine) just before the SCREEN$. Set it back afterwards with POKE 23606,0: POKE 23607,60. SCREEN$ will return an upper case letter A to U corresponding to the appropriate user-defined graphic.

If the specified character is not a user-defined graphic then SCREEN$ will return an empty string. You can check through both the RAM and ROM characters with POKE 23606,80: POKE 23607,253: LET A$ = SCREEN$(a,b) followed by IF A$ = "" THEN POKE 23606,0: POKE 23607,60: LET A$ = SCREEN$(a,b).

N J Osborn,
Bristol

Rapid repeat

A few POKEs for the Lynx. To speed up the rather slow auto repeat facility POKE &6233,2 and POKE &6234,2. These can be reset by POKEing them with 0.

The Lynx has a built in double-height facility using VDU 24 and 25 but you can have even larger characters if you POKE &6273,96. Set things back to normal with POKE &6273,32.

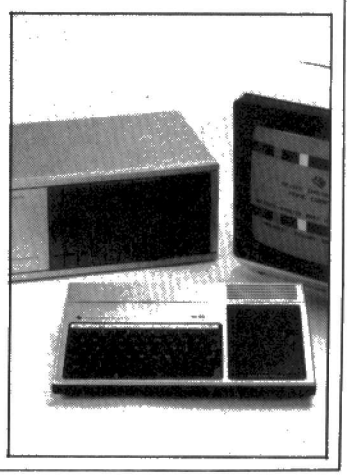
S Gray,
Dunstable, Bedfordshire

TI Print At

TI basic lacks a PRINT AT command. You can use the following routine to print anywhere on the screen. Just set A$ equal to the text to be printed and R and C to the row and column numbers.

```
100 CALL CLEAR
110 A$= "LIST"
120 R=12
130 C=10
140 CN=0
150 FOR I = 1 TO LENS (A$)
160 CN=CN+1
170 CALL
    HCHAR(R,C+CN,ASC
    (SEG$ A$,I,1)))
180 NEXT I
```

B W Davis,
Boney Hay



Don't carry a LOAD on your shoulders, unburden yourself on *PCN*'s letters page.

Share your thoughts in the UK's liveliest micro weekly letters columns. Funny, feisty or fanciful, your letter could win you £10 if it's of star status.
WRITE TO: Random Access, *Personal Computer News*, VNU, Evelyn House, 62 Oxford Street, London W1A 2HG.

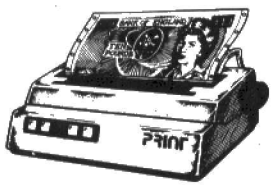
A new look from view

Isn't it amazing how even the simplest things can make life so much easier?

Having just purchased a copy of Acornsoft's word processor package View, I have spent the past week thrilled with the excellence of the product.

However, it suffers from two drawbacks — one of which I am not clever enough to overcome, but the other I can offer some advice on. Both relate to the use of the BBC's function keys to carry out standard operations such as setting text markers, changing text modes, deleting characters and lines, etc.

PCN £10 Star Letter



The first relates to the problem of redefining the function keys themselves. View uses the ten red function keys in each of the BBC's three control modes of 'normal', 'shift' and 'control' to product 30 (actually 29) different word-processing functions. Unfortunately, they are very badly arranged, so that different delete functions, for example, occur in all three modes.

Because there appears to be no logic to the key arrangements, it is difficult to remember what key does what, and this often leads to mistakes. Indeed, the 'Delete to the end of line' function key is right next to the 'move cursor to the beginning of line' key — an arrangement which causes occasional frustration due to the inadvertent loss of text! I would dearly like to be able to rearrange the keys to suit my own (and I am sure other people's) ideas of what each function key should do. Can anyone help?

The second problem relates to the crib sheet that is supplied with View — an excellent idea. It is actually a printed card that is positioned under the Perspex holder above the function keys and tells you which key, and in which mode, to press for different functions. Again Acornsoft has got it ergonomically wrong, but this time, because the solution is easy, I can do something about it. Quite simply, the problem is this: the top line of the crib sheet indicates the functions that each key takes when the control key is kept down; the next line relates to the shift key; while the third line indicates the function keys' normal uses — without any other key being pressed at the same time.

Unfortunately this doesn't relate to the actual use of the keyboard — it presents what ergonomists call a 'control/display' problem. On the keyboard the normal, shift and control keys are arranged differently; the function keys are at the top; then, further down the board, comes the shift key; then the control key. This means that a typist in a hurry will often look at the crib sheet and press the wrong key (perhaps control instead of no key, or shift instead of control) in conjunction with a function key.

I soon became very annoyed, for example, when I was concatenating lines instead of setting a marker, or deleting characters when I wanted to go into the 'right justify' mode.

The solution, of course, is quite simple: take a sharp pair of scissors and cut along the white, horizontal dividing line between the shift and 'normal' function indicators. Then with clear sticky tape reverse the position of the two strips: stick the small, 'normal function' strip at the top — above the control function indicator.
D J Oborne,
University of Wales, Swansea

Touch of balance from Scales

I must write in praise of Ian Scales' article 'Torch Packs a Punch' *PCN* issue 16). Not only was the article clear and well written, providing an excellent impression of the Torch Z80 Disc Pack, but the author took time out to say what CP/M stands for!

I feel I am quite conversant with computer jargon, and few acronyms pass my gaze undefined. But occasionally, when particular jargon is not encountered often in normal computer hobbyists activities, I'm soon lost among the crowd of letters.

I don't ask for pages of definitions every issue, but the odd reminder by article authors or by means of editorial notes, referring to abbreviations encountered in a passage, would be very helpful. Especially, I'm sure, to those new to the world of computing. A passage comparing the relative merits of 'CPN' and 'CP/M', however lucid, is meaningless if the reader has no idea what the letters stand for. Although discovered often some definitions slip from the mind — like it or not, human memory is more akin to RAM than ROM!
PS.
CP/M = Control Program for Microprocessors
CPN = Control Program Nucleus
RAM = Random Access Memory
ROM = Read Only Memory
A C Hartley
Wetherby, Yorks

I can understand your problem! That's why we devised Micropaedia, which you can pull out week by week and build into your own reference library covering the whole range of microcomputing. Coming is a series on CP/M, there'll be one on a language soon, another on a micro and so on — Ed.

Wanted – bits for business

Being (almost) the proud possessors of sundry BBC Bs tied into three Econets (when Acorn have enough chips, buy in enough interfaces, put together enough PCBs, get them out to the x million other people who ordered them before we did . . . and all the other reasons we have been told for the delays so far) we are searching — desperately — for business software to run on them.

We need finance packages, calculation packages, data = bases, a decent word-processing package etc etc. Can anyone help? If anyone has magic training packages as well, please let us know. Being a registered charity, we are able to offer the realisation to those who help with this information that they will receive their just rewards in the hereafter in that great database in the sky!
David Fitzpatrick
Wandsworth Training Agency
London SW18 (01-874 9244)

The Apple isn't over-ripe yet

After I had read L Lazarus' letter *(PCN* issue 16) I decided to write this letter. I have been a founder subscriber since the first issue was launched, with one of the reasons being your magazine was one of the few magazines that published Apple II program listings. But, to my disappointment, all the later issues of the magazine have lost the trace of more listings.

In Micropaedia, volume 3, in which the graphic powers of six popular micros are described, may I ask why the Apple II is not included in the series? Is the micro not popular enough, or is is not being considered an up-to-date micro?

As an Apple II user, I hope the general readers will contribute more program listings to ProgramCards and tips to Microwaves for a wider range of micros, and do not confine the magazine to just the Beeb, Spectrum and Dragon.
J Nagy
London W1

I hope Apple's part in Sound Micropaedia was music to your ears after its earlier non-appearance in the graphics series. Alas, we can't include all machines all of the time, but we try to give Apple — and others — a fair bite of the space. But what about those Apple programs? Send them in and we'll put them on cards — Ed.

Calling Lancs Sinclair users

I am thinking of starting a Sinclair user's club in the Tameside, Lancs, area, but first of all I'd like to find out if enough people are interested. If anyone would like to have such a club in operation please contact me at, 17 Crawford Terrace, Ashton-under-Lyne, Lancs. All letters sent to me at this address, will be acknowledged.
J Wright
Lancs

Insurance will cushion you against the crash — if your policy is right, says Ralph Bancroft.

Covered your micro?

So you've spent several hundred pounds or more on a microcomputer system and the system crashes on you. What do you do?

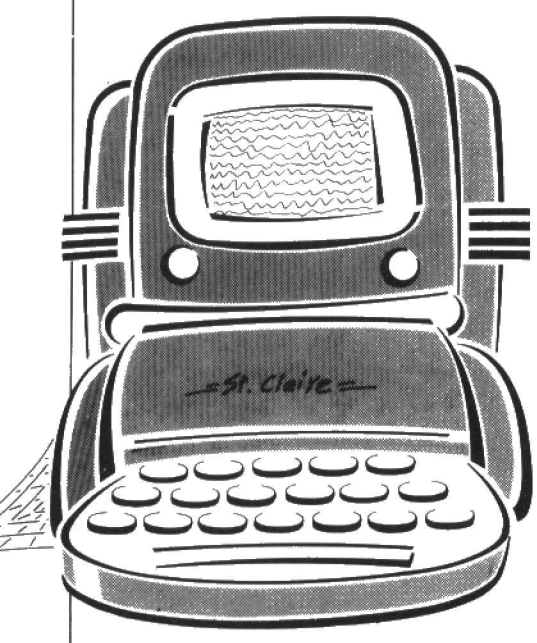
If the micro has failed because of a fault in, say, a ROM chip and you are still under guarantee there should be no problem. The supplier or manufacturer will repair it for you.

But what if the guarantee runs out after a year (or as little as 90 days in many cases) and disaster strikes? You will soon find that repairs could cost up to £30 an hour for labour with the cost of parts on top.

One solution would be to take out a maintenance contract. Unfortunately, this could cost you up to 15 per cent of the purchase price of the equipment. An expensive solution, especially if you go several years without a system breakdown. In addition, the maintenance contract doesn't cover you if the micro is stolen.

Increasingly users are looking to insurance to protect then against the disasters that can befall their equipment. And insurance companies and brokers are coming out with a range of policies to oblige.

But beware, microcomputer insurance like other forms of insurance can often be a minefield. The cautious buyer should shop around and carefully examine the fine print of the policy he is offered. Remember, you want the insurance cover to match your needs exactly. You don't want to pay for insurance against those events that are unlikely to happen to you or would not involve you in a major financial loss. Similarly, you don't want a policy that is so shot full of holes that the insurance company can always find a reason not to pay the full amount of your claim.



WEAR AND TEAR

MECHANICAL FAILURE

The options

The home user with a £100 micro that never leaves the house may decide that all he needs to do is to insure against the micro being stolen or damaged by fire. In this case it is simply a matter of including the micro on the family's household contents insurance. If the micro breaks down it will either be cheap to fix or an excuse to buy a new machine.

However, for many users it is not just the micro they want to insure but also a printer, cassette recorder, disk drives and a variety of add ons. Again, your household contents policy may offer a solution.

Commercial Union has started offering an extension to its Golden Key and Silver Key policies that covers 'all parts of the electronic data processing installation used only for private purposes while contained in your home' against 'damage resulting from electrical or mechanical defect causing an unforeseen stoppage'.

Read the words carefully. If the breakdown occurs while you have it round at a friend's house, you won't be covered. Nor will you be covered if you are using the system for business. Nor will you be covered if the breakdown occurs because of a deliberate action on your part, *ie* pushing a plug in the wrong way round.

There are other catches as well. The first £25 of any repair cost will have to be paid by you (called the excess) and you are not covered for the cost of repairs due to wear, tear or depreciation (noticed how quickly the value of micros depreciates?)

The cost compared to more comprehensive policies though is relatively inexpensive. You pay a minimum annual premium on a system worth £200 to £400. Above that, the annual cost is 2.5 per cent of the value.

If your household contents policy is not a Commerical Union one, it is still worth inquiring what your insurance company can offer. Insurance is a very competitive field and changing all the time. It may well be that your policy now has a computer breakdown option.

Incidentally, similar extensions to office contents policies may also be available to business users. So again, it is worth checking if you think this is the kind of insurance cover you need.

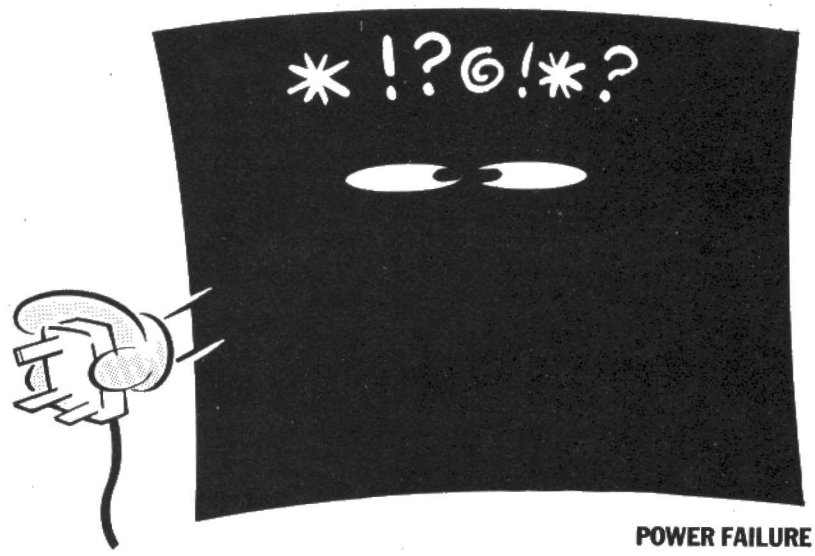
Specialist policies

For those requiring something more comprehensive in the way of computer insurance the next step up is a specialised or tailor made policy. Commercial Union, Eagle Star, British Engine (part of the Royal Group), National Vulcan (part of Sun Alliance), Cornhill and Trident General all offer this kind of policy.

The policies normally offer a series of options which can be included if they are appropriate to your needs. Costs vary but for equipment valued up to £1,000 it should be possible to obtain insurance cover for 'all risks' (fire, theft and accidental damage) and machine breakdown for as little as £25. Thereafter, the costs work out at around 2.5 per cent of the equipment's value.

If you also want to include insurance cover for when the micro is out of the home or office, for the cost of reinstating lost data, or consequential losses, then you will have to pay more, increasing the premium to 7.5 per cent or more.

If this sounds all too confusing and you want to buy something 'off the shelf', then one of the policies offered by different insurance brokers may have what you are looking for.



POWER FAILURE

A list of brokers specialising in micro-computer insurance is given below.

Costs, of course, vary according to the value of your system and the scope of the policy offered. And as always it pays to shop around. Some of the brokers have special provisions.

For instance, the micro must be less than two years old when the policy is taken out. Others might offer a better deal on low cost systems like those worth under £500. Also the excess amount varies and loopholes like 'wear and tear' or 'derangement' clauses could account for the differences in the quotations you are given.

Extended guarantee

A slighly different, no fuss, approach has been adopted by the Computer for All chain of independent micro shops. It has started to offer what it calls an 'extended guarantee plan'.

It is an insurance policy that you buy from the retailer at the same time as the equipment or within 30 days of purchase. It covers you for the cost of repair through mechanical or electrical breakdown, but not for loss due to fire or theft, nor the cost of reinstating lost data. The cost works out at something like 7.5 per cent of the value of the equipment and is certainly more expensive than the specialised policies mentioned above.

The advantages from the user's point of view are that insurance cover is purchased on the same day as the micro, there is no excess charged in repairs and you get a speedy settlement of your claim (a plus point not be underrated — some companies can take several months to sort out the paperwork.

The normal arrangement is that when your micro breaks down you simply return it to the retailer who carries out the repairs. You don't pay a thing as the retailer recovers his costs direct from the insurance company.

Details: Graham Brown & Co, 0483-65651; Peter Davies Associates, 0222-394277; Halsey & Company, 0272-503716; Geoffrey Hoodless 04862-61082; KGJ Insurance Brokers, 03843-5333; Computers for All, 0268-418414.

TERMS TO LOOK OUT FOR

All risks The usual sort of insurance as in your house contents policy. It includes fire, theft and accidental damage.

Physical damage Covers the machine being dropped or something being dropped on it as well as other accidents that result in the micro being broken.

Mechanical failure This term is a hangover from the days when everything worked mechanically. In the context of a computer, it covers electronic failure.

Derangement Minor faults that fall short of a total breakdown, *eg.* a loose connection or plug.

Consequential loss A broad term that may or may not cover the increased cost of working in a business due to the computer's going down, loss of earnings because of the failure, and cost of hiring another micro.

Reinstatement of data The cost involved in re-collecting and re-inputting data that was lost when the computer went down. This should also cover cost of software lost.

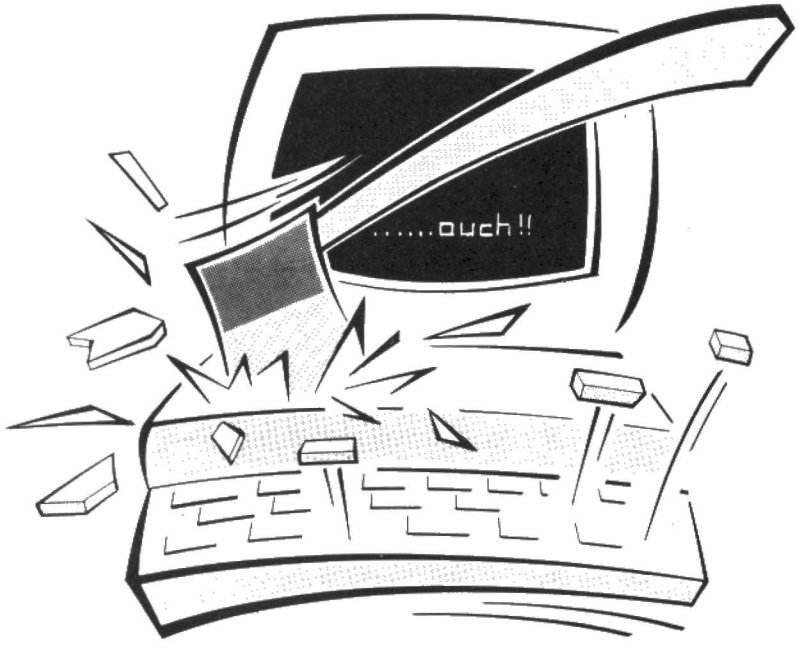
Locations It's worth checking this. Some policies cover you only if the micro is used in a specified location, ie, your home. Others include anything from two or more specified locations to anywhere you take your micro.

Transit There is no point in having insurance cover when you use your micro in more than one location if you are not covered when moving the equipment around. If you want cover against theft make sure theft from a vehicle or hotel room is also included.

Power failure Again, not all policies cover you for this. But watch out, most policies don't count power failure due to industrial or deliberate action (such as accidentally pulling the plug out).

Wear and tear Often not covered in an insurance policy. A useful let-out for the insurance company since it can claim that the reason your micro failed was that it was simply old and worn out.

Excess As with most kinds of insurance policy, you will not get the full amount of your claim. You will be expected to meet at least part of the claim yourself. Designed to stop claims for small amounts that would not justify the paperwork.



PHYSICAL DAMAGE

LOCATIONS

Sandra Grandison hacks through the Billboard jungle.

WORTH £300? ONO

My old ZX81 has been tucked in a cupboard for some months now. It was a good little mover in its time and £70 for a IK machine was a bargain back in 1981.

But the market has changed. The little beast has been superceded and the current price war has pushed its price to as low as £30. So it's time to cut my ZX ties and move to bigger things. I wanted to go for a BBC B; but things are never that easy. Cash was short and I couldn't stretch the budget to the £800 I'd need for the micro, disk interface and drives.

But all was not lost . . . what about buying secondhand, *à la PCN* Billboard?

So I looked. There they were: BBC B with 1.2 ROM and a few Acornsoft packages thrown in for £365 . . . a Beeb with OS 1.2, disk interface and double disk drives with 400K for £325. The 'absolute bargain' at £295 caught my eye.

'You're too late,' said the voice at the end of the phone. 'I've sold it. Micros are just not my cup of tea. The machine was a present, it was only two months old. I'm now going to buy one of those big cassette recorders with the money I got.'

I then paused over the 'unwanted gift' from Angeline. It was at this point I wished that, like one Billboard advertiser, I had something to swop, like his Honda 250 Superdream complete with leather boots.

But no. This was to be hard cash and I had to be sure I was spending it wisely. Buying a secondhand micro holds the same fear for me as buying a secondhand car; you're likely to end up with a pile of junk unless you know what to look for.

So I devised a checklist of things to remember when closeted with the seller and his bargain buy. Like buying a car, it's easy to forget what nasties could be lurking under the gleam when faced with the machine you've set your heart on.

It's also worth noting that there's little point buying a secondhand micro if you have to go hundreds of miles to collect it, because this adds to the cost.

Bill McCool, press officer for the National Computing Centre, said: 'It's fatal for businessmen to buy secondhand equipment because they need maintenance and support. Micros are a throw-away system and it's not a good idea for someone buying a computer for the first time to buy one secondhand — unless he knows what he is doing.

'Secondhand machines are a good idea for chaps who are good with a soldering iron and want to expand their computers. Micros have a built-in life of about five to seven years, after this time they begin to acquire faults. It's not advisable to buy a machine if it's too old.'

A couple of computer manufacturers seemed very conscious of the secondhand market, but had no figures to show how it was affecting their sales.

A spokesman for Acorn said he was glad to see a secondhand market, but he was quick to point out that when you buy such a machine you have no comeback if anything goes wrong.

'Acorn would warn a secondhand buyer that he wouldn't get the same support he would if he bought a machine from a dealer,' he said. 'Secondhand machines are a good idea for people who can't afford to buy a new computer, but the user should take care.

'I would suggest it would be a better bet if you bought a secondhand machine from a user club or an acquaintance, as you're less likely to get someone diddle you.'

POINTS TO REMEMBER

1. Look at which keys have been used most.
2. Check the keys have good spring.
3. Make sure all keytops are in the right place.
4. Check there's been no tampering with built-in interfaces.
5. Insist that the owner open the machine so you can check everything's in place.
6. Make sure plugs and sockets are not bent.
7. Make sure you get the user manual, leads and all accessories.
8. Find out if the machine is still guaranteed.
9. Ask if the machine has had any disorders.
10. Test it to check for problems like overheating.
11. Ask why the owner is selling and what the micro has been used for.
12. Make sure none of the pins on the interfaces shows signs of scratching — this could mean they've been bent and straightened.
13. Do a RAM test, or several (at least ten times and cycle it if possible).
14. Try a program that you know well and make sure everything works correctly.

A Sinclair spokesman felt there'd been no major impact on sales due to the growing secondhand micro market. However, he gave some sound advice when hunting down a cheap machine.

'I would be concerned whether the machine was under guarantee, that all documentation was there and finally have it demonstrated or give it a test run myself,' he said.

At the moment there are growing facilities for trade-ins at local dealers and more in the pipeline. With regards to the guarantee, the dealers I contacted said they would honour any warranty on a machine no matter how many previous owners it had.

The manager of Rumbelows, in Edgware Road, London, said: 'People selling micros are asking too much for them. They don't realise that the market has gone down and sell their machines at unrealistic prices — *ie* if they bought it for £300 they'll sell it for £200.

'Another point to stress is that you shouldn't buy a secondhand micro unless you know something about computers. If you're unable to test it yourself, get one of your friends who knows something about computers to give it a run until you're both satisfied.'

On the whole dealers thought the price of the BBC would hold and if I got a machine with at least three months' guarantee left on it for a reasonable price, I was on to a winner.

PCN Billbo

ATARI VCS for sale + 77 cartridges, including Combat, Starmaster, Asteroids, Missile Command, Maze Craze, Raiders of the Lost Ark, Warlords, Yar's Revenge etc, etc. Reason for sale: frayed index finger. Bargain at £150. Tel: 01-226 0322.

Spectrum software 16K/48K for sale, exchange. Chess Player, Flight Simulation, Penetrator, Death Race, T. Tower, etc, etc. Tel: Wigan (0942) 497352, 6pm to 7pm weekdays.

ZX81 1K with software, manual, leads and programs magazines, software includes Orbital Invaders, Skier, Star Destroyer and many more, worth £55.

DUMB blonde will pay good price for mattel Intellivision console with Intellivoice voice synthesis module + voice cartridges. Tel after 10pm, ask for Lulu.

For sale ZX81 machine code books, £6 each, also Hints and Tips for £3, and The ZX80 Magic Book for £4. Tel: Stonehenge 42324, evenings weekends.

Texas TI 99/4A, brand new, hardly used, in original packaging, joysticks and Attack games cartridge included. Worth £190, sell for £120. Tel: 01-949 2351

FOR SALE: Pet (K9), fully house trained. £100 including training manual and leads. Tel: Barking 22.

WILL SWOP dancing pumps, truss, bottle of Brilliantine, boxed set of Victor Sylvester 78s and year's season ticket to Mecca Ballrooms for IBM PC with Unix disk.

DRAGON 32 for sale, including games cartridges: Vultures of Namtir, Bodycount, Astrar-Blaster, Atomic War, Gook Zap, Killers from Mars. One careful owner, £150.

Wanted, Nascom disk system or Micropolis drives (no controller board required) or cheap CP/M computer-bridge. 363 Kennington Lane, Vauxhall, London

STATE of the art business software: Time Sheet — cook the books retrospectively with this 4D spreadsheet: Word Con — the only fully automated WP program, sends out randomly generated excuses to customers; Monster Mail — 3D space intruders through the post! Call Gizmo Programs (1983) Ltd after 6pm on Ripoff 999.

Oric 1 48K, mint, lead, £145. Tel: Sh

16K, Spectrum wit Spectrum tape hea and about £20 wo £160, offers. Tel: 0

Atari VCS with nin Star Raiders, Aster Man, Riddle of S paddles for four £350, accept £200 5pm, (0642) 76317

Commodore 64 s Mutant Camels Hitch Hiker's Guid original. Tel: Gar 01-958 6408 eves.

Wanted for adventure and pi condition, also a Tel: Blackpool (0 (weekdays), anyti

Radofin colour TV Codebreaker, Cir tridges, all in excel the lot. Tel: Holb

Vic20 Pirate Cov Physics Revision Arrow of Death Rodgers, Sheffiel 698756 eves.

TRS 80 Mod L2 so spare cassettes, worth over £270, bargain at £165 thorpe (0724) 782

Atari 800 400 Bas Raiders, £18, all condition. Tel: 01 Sundays, ask for

Vic20 cartridge t Chess, £15 each. Mole Attack and Also cassettes fo after 6pm.

Torch Z80 disk pa interface and up MX80 FT III pri after 6pm.

48K Spectrum f Over £120 worth ZX printer with fi 0734 783563 after

BBC B with colou also books and months old. O 550372 after 6pm sell.

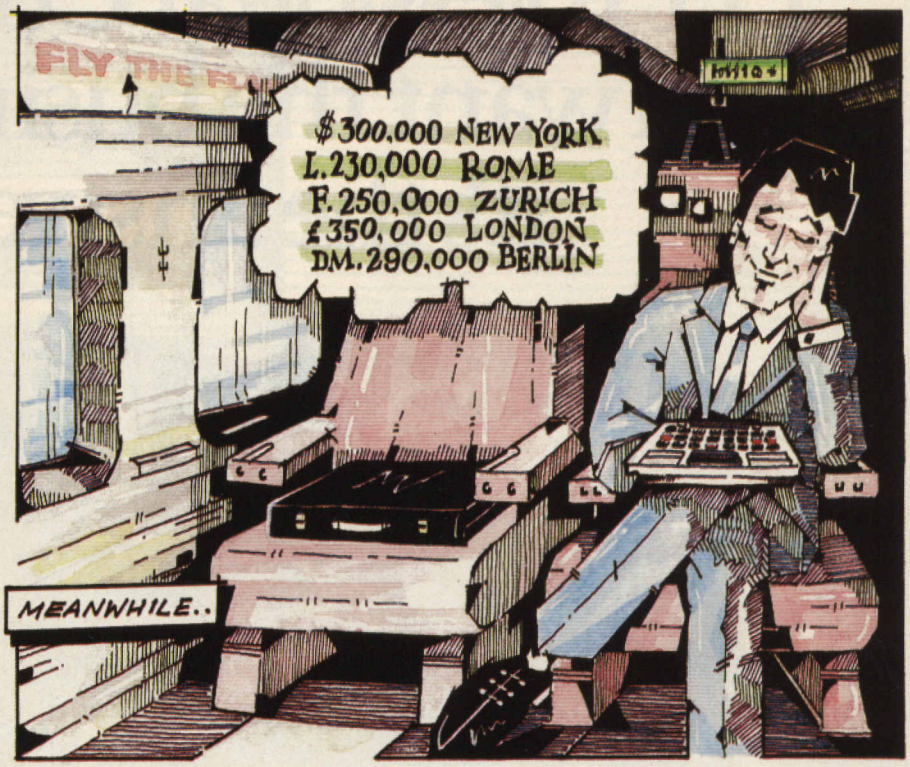
Atari 400 guara wanted gift wit manuals, recor Preppie, Miner cost £360, acce 604294 (after 6p

Apple II software games include per Puckman, S Blaster, Snake 8801, weekdays

Henry Velleman tots up the value of the MST stock control program to Epson's portable baby.

HX-20's stock answer

Having trouble keeping control of your stock? If you have less than 800 different items, need a portable system and don't wish to spend over £500, then Epson plus MST could offer a solution.



Gary Davies

Features

The MST Stock Control program runs on Epson's HX-20 baby microcomputer, which with the optical microcassette unit costs £502, including £25 for the program. The program maintains a record of all stock items and consists of a 20-character description, the cost and selling prices (restricted to £9999.99), the current quantity in stock, and a re-order level.

From this record the program will produce reports on the HX-20's built-in printer of full stock listing, re-order list and stock evaluation. However, a major drawback is that although it prints a full date and time indexed audit trail for any item bought, sold or deleted it is possible to use the amend function to alter quantities in stock without leaving a trace. This means stock levels could be altered and you may never find out, everything appearing totally 'kosher' on the printed audit trail.

Presentation

The MST stock control package consists of a microcassette containing the 6.5K Basic program plus a photocopied seven-page instruction leaflet.

The leaflet covers most aspects of operation adequately but is jumbled and apt to confuse. I have read and re-read the section 'change depts', which covers changing data tapes, and still find it barely comprehensible even though nearly two pages are devoted to it.

Not enough emphasis is given to maintaining back-up data tapes or even how to produce them easily. This could be a serious problem, as the program does not always give warning that it is about to rewrite your stock data to tape, thus possibly obliterating the data already recorded.

In use

The program is easy to install if you follow the instructions given, with the exception of actually resetting the HX-20, where one is referred to the unhelpful Epson manual.

Although not documented, the program is for the standard 16K RAM version of the HX-20 and no way of taking advantage of the optional 16K RAM pack is given. This is unfortunate as I estimate that the number of stock items in the computer at any one time could be increased from 100 to 300, reducing the need to muck about with data cassettes.

The concept of departments is used as a convenient way of dividing up your stock into batches of 100 items. Each department is saved as a separate data tape file, with four departments per tape side. Depending on your type of business, there may be no easy way to divide your stock up for this purpose. This could produce major problems when continually moving from one data tape file to another, a process taking just under two minutes.

The program has a flexible, and surprisingly fast, search facility to find a stock description when you cannot quite remember it correctly. This can prove very handy, as with up to eight sets of data, each numbered from 1 to 100, things could soon become very confusing.

Reliability

With the exception of inadequate safeguards against overwriting your data tapes, the program is reasonably robust. Despite dire warnings to the contrary, use of the HX-20 Break key is not likely to damage your data — just type RUN and you're back where you left off. I would like to have seen an option specifically included for cleanly finishing the program, rather than a half-baked use of the 'change depts' option.

Normal turning on of the system does not prompt you to load a selected data tape file as the instructions state. Instead, you automatically have the stock details of the last tape file used. This may be very handy, but if you don't it is necessary to resort to 'Change depts'.

Verdict

The MST Stock Control program has most of the rudimentary features required but is seriously flawed by the ease with which stock levels can be altered.

This may not worry you if you are, for instance, a one-man business, but will your accountant or the taxman accept an audit trail thus produced?

Another major drawback is the limit of 100 stock items in the computer at any one time. Again, you may not be too worried by this. Be warned, however, that the move between data files is at best described as messy, with you needing to keep a manual record of which items are saved in which tape file.

The stock reports are all adequate, if somewhat cluttered by the necessary limitation of the 24-column built-in printer.

A final thought: with more and more items being manufactured with a bar coding, and the Epson HX-20, a portable computer for which a barcode reader is an option, wouldn't it be nice if a stock control program offered the possibility of using the barcode to make physical stocktaking a piece of cake?

RATING

Features	■■
Documentation	■■
Performance	■■
User-interface	■■■■
Reliability	■■■
Overall value	■■

Name MST Stock Control **Application** General-purpose stock control **System** Epson HX-20 **Price** £25 **Publisher** MST Consultants **Language** Microsoft Extended Basic **Outlets** Mail order.

Keep in touch with your Torch. Ralph Bancroft on the line with Mail Plus.

Long distance micro

Every once in a while, and then not too often, a new piece of software appears that has a little hint of magic about it.

Torch Mail Plus is such a program. And, in the same way that VisiCalc sold a lot of Apples, so Mail Plus may sell a lot of Torches.

The program is the latest electronic mail package to come out of the Torch stable and draws on the experience gained from the earlier offerings.

Features

Mail Plus is an electronic mail system with advanced features including timed events, automatic command execution, ability to control remote Torches, direct micro to micro communication through normal telephone network, full file transfer between micros, autodial/auto-answer capability, local file and director operations and interlinks with other programs.

In use

Mail Plus comes as a single disk. After several seconds for loading, the idle screen appears which displays the package name, the name of the user and a calendar/clock.

Below the package title appears details of who is using Torch Mail and where. These can be easily changed by setting up an obey file called by the program when it is run. This can be particularly useful in companies where there are several users or the location at which it is used is changed occasionally.

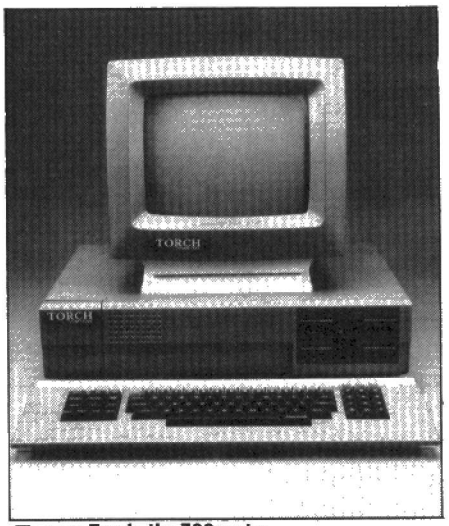
Below this part of the screen there is a line on which your messages, personal reminders and error messages appear.

The rest of the idle screen consists of the options you can select.

One of the Torch's programmable function keys is used as a help button. A small help screen appears on the right of the display with information about the current option. Despite having virtually minimal documentation from Torch (the manual was still in the process of being completed) it was possible to learn very quickly how to use the package by resorting to the help button.

The help facility is available no matter what part of the package you are in.

Having selected an option (done by typing in the number and then pressing the 'exact space' key) you are confronted by a screen asking for the completion of a series of boxes. You can cut through the quandary of what to do next by pressing the help key to find out what information is required together with instructions on cursor control and how to return to the idle screen.



The new Torch, the 700 series.

There are fifteen options selectable from the idle screen.

The first two allow you to call a remote Torch, in various ways. The simplest is to press the BEGIN key.

After you enter an index letter, Mail Plus calls up the telephone number from a file held on disk and automatically dials the number for you.

If you can't remember the index letter of the Torch you want to call you can select the 'Call remote Torch' option. This takes you to a screen requesting details such as name, telephone number, password and privileges. You can either give the information or call it up from a pre-set file.

The final way of making contact with a remote Torch is to use operator-connected calls. This is used where it is not possible to dial into the Torch direct such as is the case in the *PCN* offices where out Torch is currently attached to an extension.

If talking to another Torch is not to your taste you can always send someone an alarm call. You can set up the number to be called, the number of rings before calling off and the time you want the call to be made. You can also pre-program the Torch to repeat the call at selected intervals.

Mail Plus is designed to run on a continuous basis which could cause problems if you wanted to run other applications on the machine such as Wordstar or Torch's Prestel package, Torchtel.

It gets round this difficulty by including a 'Timed command execution' option. The time selected can be either immediate or some time in the future, but the only commands that are accepted are ones to run a program.

I cannot see many people using this option to run a program at some time in the future since the program itself will probably require keyboard or other input. Its main use will be to exit Mail Plus temporarily to run another program.

An element of Mail Plus remains in memory so when you exit the other program you automatically return to Mail Plus with all the switches and the clock set as before. This is a powerful feature that in effect turns Mail Plus into an operating environment.

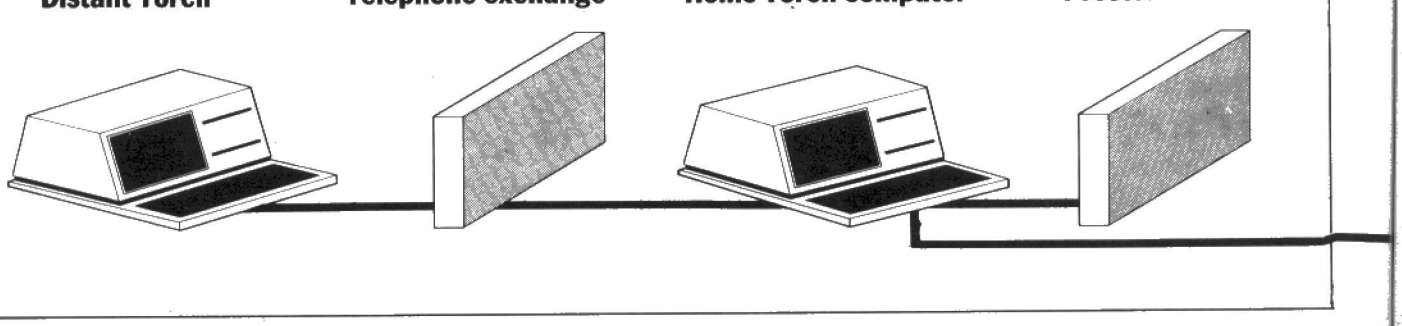
Another timed event feature of Mail Plus is the 'Create personal reminder' option. This allows you to create a short message that flashes up on the idle screen or option selected screen at a predetermined time.

In setting up timed events on Mail Plus it is possible to specify both the date and time at which you want the event to occur, how many times you want it repeated (up to 998 times or infinitely) and at what fixed frequency (which can be measured in anything from minutes to years).

Timed events will only execute while it is idle. This is a valuable precaution. Nothing could be worse than the Torch going into a timed command to run, say, Torchtel while you are in the middle of typing up a long Wordstar file.

This can be frustrating as Mail Plus will execute the timed event at the next available opportunity.

Other local operations that can be executed from within the Mail Plus program are file handling commands including typing, printing, renaming, deleting and copying. You can also protect



files or drives from remote read or write access.

Before you can establish a link with a remote Torch, you need to know what passwords are acceptable to the remote machine and the privileges attached.

The privileges that can be accorded to someone phoning in are: send files, receive files, read a directory, send messages, and send obey files with or without program runs.

The sender will also have set up privileges connected with a particular password but they need not be the same.

So it is possible to have two Torches talking to one another where one has the whole range of privileges open and the other can only send files or messages.

A second level of protection is given by locking access to specific drives or files, though there is no method of allowing access to specified files to a restricted list of remote Torches. Any remote Torch has access to all unprotected files or to none.

Certain files are automatically locked. These include the Mail Plus system files, message files and files that have been received from a remote machine.

When contact is established with a remote Torch the identity of the remote Torch and the privileges accorded to each machine is displayed.

Some of the options are the same as for the main idle screen: personal reminders, change switches, local file operations and file/drive protection.

The first option that you are likely to select is 'Directory of remote Torch'. This allows you to see what files are on the remote Torch and available for request. These are highlighted on the screen which also displays the amount of memory they take up.

This is a useful facility as it avoids having to find out in advance the exact name of the file you want and the drive it resides on.

Requesting a file is then a straightforward process. Selecting the relevant option you enter the name of the file and whether you want to file it on disk on your own machine either as a message file or with a specific file name. If it is a text file you can type it on screen as it is transmitted or send it to a printer.

The Torch communicates at 1200 baud in both directions with the result that it is noticeably slower than the normal response you expect from a micro, particularly when typing commands or text on the remote screen.

The transfer of files can therefore take some time. A typical program taking up 20K of memory would take something like 15 minutes to transfer.

The file transfer capability is remarkably error free. Over several weeks' use there were only one or two occasions when the transfer failed because of line noise or some other error in transmission.

Mail Plus can also be used to send messages to a remote Torch. There are two ways of doing this. The 'Send a message' option allows you to send short messages that appear on the screen of the remote Torch as they are received. An alternative is to create a text file while off line and then file it on the remote Torch using the 'send a file' option.

It is this electronic mail capability that will make Mail Plus attractive to commercial users.

It is faster, cheaper and more flexible than using telex, and unlike British Telecom Gold it gives micro to micro communication. And it's undoubtedly quicker than using the post.

The unique feature of Mail Plus is its Tobey compiler. It is a high level language that allows you to create a file holding a series of instructions to be executed by a local or remote Torch.

All the facilities of Mail Plus are available for compilation into an 'obey' file. And the obey file can be executed immediately or at some pre-set time in the future.

The possibilities are endless. At the frivolous level you can create files that tell one Torch to phone a second Torch which send a third Torch a music file. The third Torch then plays the music file and sends a message to the first Torch that it has played the music file successfully. What you might call a 'hands off' experience.

At a more practical level you can use Tobey to program a Torch to carry out local operations, like backing up files at the end of the working day, without operator intervention. Alternatively, you can program the Torch to send out its electronic rates.

Conditional events can be included in an obey file. So it is possible to tell the Torch what to do if a call is unsuccessful. It could be to ring again in, say, 15 minutes or alternatively to ring another Torch.

Tobey is the major plus in Mail Plus that puts it streets ahead of anything else in the electronic mail market.

Reliability

We have had Mail Plus under test at *PCN* for three weeks and extensive use has been made of it. It has been run on our Torch as a 'front end' to the other frequently used software on the Torch (Wordstar and Torchtel) as well as for electronic mail. Throughout that time the software could not be faulted.

Mail Plus has a built-in error handling capability that allows the package to recover gracefully from errors instead of aborting the program or hanging the system.

Verdict

As a front end operating system Mail Plus is a delight to use and a definite advance over Interactive Torch Mail. Most operations could be carried out without having to exit the system.

As an electronic mail system it is both flexible and powerful. It is also easy to use. When transmitting a file it only took a few minutes to brief someone in the office on how to use the package.

As a means of sending software over public telephone lines it proved reliable (within the limits of British Telecom's technology) as well as quick.

As a means of programming the Torch to carry out instructions at some time in the future, Mail Plus has that little bit of magic.

Someday all computers will work like this.

RATING

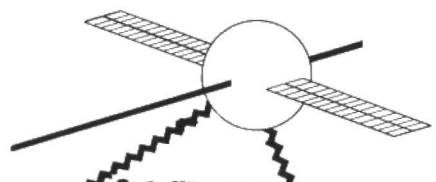
Features

Performance

Usability

Reliability

Overall value



Name Torch Mail Plus **Application** Electronic mail/operating environment **System** Torch C series and 700 series running order CPN **Price** £690 **Format** Disk **Language** Pascal **Outlets** Torch dealers.

Mail Plus takes full advantage of the Torch's communication capabilities. You can use it to program your Torch to phone up any other Torch anywhere in the world. In addition to exchanging program files with the distant machine, you can send it a series of commands to be executed immediately or at some time in the future.

Smith Corona's TP1 gives a precision performance, says Barry Miles — if you can stand the noise.

Daisy decibels

The TP1 is a small daisywheel printer, described by Smith-Corona as a simple, low-cost, high-quality printer, delivering executive quality printout, and incorporating a limited number of operator controls. Any daisywheel machine at £485 will attract a lot of interest, so I was interested to test out these claims.

Getting started

The machine comes in the usual polystyrene cocoon, with extra packaging around the print-head to protect it from unwanted movement. The case is mainly off-white, with a dark band around.

You can get at the mechanism by lifting the lid, which automatically cuts off the power. Similar concern for safety is indicated by the warning about keeping hair, jewellery, etc out of the way of the mechanism. The machine itself weighs only 9.4 kilos but is nonetheless of solid construction, and is compact in size (6.4 × 19.5 × 13.5in).

It comes with either a Centronics or RS232C-compatible serial interface as standard. You must specify whether you want the 10 pitch or 12 pitch model when buying. This immediately makes you think that there is something rather unusual about the machine, and you would be right. Friction feed is standard, and there is a tractor feed option available, but this is driven by friction too.

Getting the machine going is simple — on power-up it goes into a series of movements for a few seconds, and then is ready to go. There is a single switch to set it into top of form mode or normal mode, and that is all. If you want to switch off the linefeed which is automatically provided you're out of luck. This seems to me to be carrying simplicity to the point of poverty.

There are no dip-switches to modify the printer's behaviour, and although there is nothing inherently wrong with this approach, it means you must be absolutely sure that the printer will do exactly what you want before you buy it.

The manual is clear and gives you all the information you need, including the maximum cable-length which you can safely use to hook up to your computer. There are also some very pleasant features about the machine. The knobs on the end of the platen are of rubber, and easy to grip. Line spacing can be varied by means of a very simple lever, from 6 lines per inch, through 4.5, to 3 lines per inch. A fourth setting, 0, permits the platen to roll freely.

There is also a variable line spacing wheel, on a ratchet, to enable you to set the printing line very precisely to line it up with pre-printed forms. The alignment is further aided by the existence of three rollers on the bail bar — which is calibrated — and by indicators which show where the bottom of the characters, and the next character will print. An Impression Control Lever is also provided. This allows you to adjust for fluctuating voltages.

Top of form assumes 11in (66 line) paper, and you may use up to four-part stationery, with a maximum thickness of 0.22in. The ribbon cassettes are compact and very simple to fit. There is a lever which moves the print hammer away — this makes wheel-changing simple.

The ASCII "CAN" character controls margin release. You can set up tabs, by sending ASCII "DC2" — ASCII "DC4" will remove a setting. Again, you must move the print point to the right spot first, by spaces or backspaces. There are five different styles of wheel available, and the lack of italics is the only real criticism here.

Up and running

The average speed claimed is 12 characters per second — my tests showed this to be as true as other similar claims. The machine is not bi-directional logic-seeking, so will tend to be slower than a machine which offers that facility.

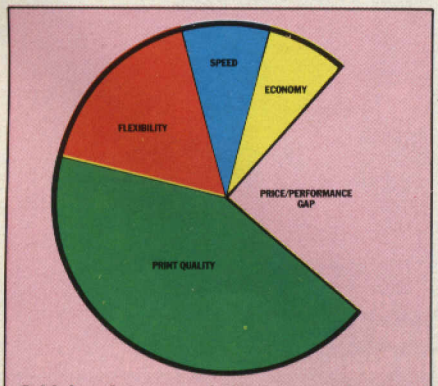
The noise level is appalling. It is rated at 63 to 69 decibels, which does not sound too bad, but this doesn't take the character of the noise into account. The point is that a type of rack-and-pinion transport is employed — which is why you can have only one pitch — and the noise of this is far more penetrating than the usual form of transport.

The noise is present whenever the head is moving about, so spaces are as noisy as characters. Having tested printers where the only sound is of a very quiet fan, and light typing sounds, this burst of machine gun fire is a shock. It didn't get any better with time, either.

Verdict

The TP1 is a cheap, easy to use printer, which produces very clear, attractive printout, and has been designed to be easy to operate. The ribbons and wheels are very cheap indeed at £2 and £7.50 respectively.

If you can live with the noise, and do not require a wider range of facilities than are provided, then the price performance ratio is attractive. For me, the noise makes it a non-starter. I strongly recommend you to listen to the printer, and others, before making a choice.



A high printer capability in one direction will probably cause either a low capability in another or a higher price. Economy is a negative way of expressing price.

If a printer has lots of everything it will close the price/performance gap.

Name Smith Corona TP1 daisywheel printer **Interface** parallel or RS232C **Speed** 12cps **Price** £485 plus VAT **Contact** Smith Corona 01-965 7766.

David Janda takes a TEC keyboard, a ZX101 ROM, configures a Seikosha printer and makes . . .

Sinclair WP connections

Photos by Naru

There is more than a hint of 'do-it-yourself' enthusiasm generated by the ZX81, which lacks most of the input/output features found on more expensive microcomputers.

Many people actually enjoy the challenge of building up a multi-featured system.

A plethora of peripheral peddlers has sprung up to meet the demand.

This Peripheral Pro-Test looks at a possible word-processing configuration based around the ZX81. The ZX has been housed in a moving keyboard from Telford Electronics and Computing (see *PCN, issue 8).*

The basis of our system is a combination RS232 interface and a word-processing program housed in Read Only Memory from Data-assette. The system also requires an extra 16K RAMpack.

To output the results *PCN* configured the soon-to-be-released Seikosha GP100AS which will be about the cheapest impact full-width printer available.

We managed to put together a complete WP system for £292 excluding ZX81, TV, cassette recorder, and RAMpack.

Just over a year ago Data-assette released a tape filing system for the ZX81 called the ZX99. Now the company has gone a step further and developed a serial printer interface and word processor called the ZX101. This was originally to be a WP program for the ZX99, but due to unsatisfactory results the company decided to produce another unit — hence the ZX101.

For those who have already bought the ZX99, Data-assette will be giving details of how to configure the ZX99 and ZX101 together in the manual.

ZX101 ROM

The system is housed in a box and attached to the TEC keyboard via a Sinclair edge connector. The edge connector is continued out the back so the RAMpack can be configured.

The printer is serviced by a 25 pin D-type socket. This feature can lead to problems when you try to lay your hands on a properly set up cable to run between your printer and the unit — you may have to allow an extra £20 to £30 to get a store to wire a cable with the right connections.

The casing of the unit is robust, and is made of tough black plastic. Owners of the ZX99 will realise that the same casing has been used, but with a few small changes.

Opening up the case reveals a neatly designed PCB. The empty EPROM socket next to the X-Word word-processing chip is particularly interesting. This is empty for 'future development' — the sort of development isn't specified, but my guess is something to do with communications.

Data-assette has no plans to expand the ZX101 for the time being, so don't expect any additions yet.

As mentioned, the X-Word word processor is in an EPROM within the ZX101. The memory space occupied for the word processor is between 8K and 16K on the Sinclair memory map. The EPROM is actually a 16K one, and bank switching techniques are used to make use of all the word processor. Invoking the software is done by entering RAND USR 8228 — the word processor is then run.

Firmware

X-Word isn't like some of the Micky Mouse text editors that are available for the '81. It's a professional word processor, providing many of the features you would expect on disk-based systems.

Everything happens on-screen, with format and control characters displayed. Two methods have been used to display text that is longer than 32 columns.

The default display splits lines into 30 character segments which are stacked down the screen. A small black square is

used at the start of each new line, so a line without a square means that line is being continued.

The second type of display is the window type. Here the text is left as it was typed, and the screen acts as a window, with sideways scrolling being used to view all the text. One handy feature is the use of soft spaces. When a line is padded out, a small grey bar is displayed where a 'soft' space has been inserted. This gives you a good idea how the document will look when it is sent to the printer. All options for pagination, line length, margins etc can be changed within the text if desired.

Unlike most word processors, where a cursor is used to display the next character position, X-Word uses a horizontal tab bar which is always situated below the line that is being edited. This bar has two purposes: first, it has a black square which moves along it, indicating the cursor position. Second, it is used to display tab stops, which are displayed as a 'T'. I found this feature rather nice, but others using the system found it a nuisance — you'll either love it or hate it.

The way the functions and cursor control are used is also interesting. The ZX81 hasn't got the best keyboard in the world, so the accessing of functions and so on has to be kept simple. Interact Software, which wrote the word processor, has organised the keyboard in a logical way.

By default, the alphabetic characters are in lower case, upper being accessed by holding the shift key down.

The shift key is also used to access the cursor control characters (top line). Single characters or whole words and lines can be skipped. A graphics mode is also included, but graphics only means symbols like '+','−','*' etc, and no genuine graphics characters are provided for dumping to a printer. The only way this can be achieved is if the printer you are using has graphic characters as part of its character set.

Finally, on the keyboard, functions are obtained by holding down the shift and newline key, then the newline key is released. With your finger still on the shift key, pressing another key will invoke a function. This may sound complicated, but is is very easy to get used to.

Two help files are provided for quick reference, and help is also provided by status information, which is displayed on the top of the screen in edit mode.

Setting it up

Setting up the ZX101 proved to be a little tiresome. The manual has to be read carefully before you start to stick things onto the back of the ZX81. Power *must* be disconnected before the ZX101 is attached, as failure to do so could lead to the EPROM in the ZX101 being damaged.

Once this is done, you can then attach the ZX Printer and your RAM pack to the ZX101, and power can be turned on.

There's a good chance of you running around in circles if you haven't read the manual thoroughly. Be prepared to start off slowly and methodically.

In use

Once the X-Word has been set up by entering RAND USR 8228, a front-end menu with several options is displayed. A file can be created, amended, loaded/saved or printed. If you have a document already in the memory and you try to create a new one, a message will come up on the screen asking you whether you wish to wipe out the existing text. This is a standard WP feature, and indicates the care taken in the firmware development.

There is a facility which allows you to set up a range of embedded commands. These are accessed by a shift/graphic and E. After the E, a two letter code is entered to designate which function you are going to use. I found this quite easy to use, and it enables you to set up things like line length, page length and so on.

One feature I haven't seen in any other word processor is a scratchpad area. Here text can be edited without it actually being part of the main text (it won't be printed). This area would be used to store text to be amended; another way of using it would be to store all your commonly used functions. The text in the scratchpad can be easily transferred to the main document and visa versa.

I have a few grumbles about X-Word itself. First, things tended to look a bit messy on the screen. The tab bar, newline character, beginning line marker, padded spaces *and* your text tended to make things look crowded. The option to get rid of the tab bar would have been welcome here, but was not included. It also lacks one important feature. It has no word count facility, and at present only gives you a free memory display, showing you approximately how much more room is left.

As to ergonomics, there were a few problems. You will get tired of typing text on the ZX81 keyboard, and you might consider getting a proper keyboard for the '81. Here, a problem arises. Typing with a proper keyboard is much faster than using the Sinclair ZX81's, but I found that while typing fast, a few characters would be missed. Whether this was due to the software or the '81 I don't know. Taking things a little easier cured the problem.

SEIKOSHA GP100AS

The Seikosha GP100AS is a slightly beefed-up version of the GP100, and is expected to retail at around the same price. It's unlikely that full-carriage impact printers are going to get much cheaper than the GP100AS end-user price — between £190 and £215, according to how dealers discount it — still, you never know.

Distributor DRG expects the printer to be in shops by August.

Although cheap, it doesn't look it. It's both small and light, weighing 4.5Kg.

The controls are very simple — one on/off switch and two indicator lights. The indicator lights are for power and error conditions (internal). At the back there is a sensibly placed fuse holder along with the power switch, which is of the rocker switch type. Page feed is achieved by a small click dial, which is situated on the right hand side of the top of the printer.

Removing the dust cover revealed some interesting points. First the print hammer and paper thickness adjustment are exposed on the print head platform — whether this is cutting costs or trying to make maintenance easier, I don't know. But the lack of a proper printer head cover does contribute to the loud noise the printer makes while in operation.

The paper holders and sprockets are rather strange too. Instead of opening the paper holders sideways like most printers, they have to be opened backwards. This means that you have very little clearance between paper holder and sprocket.

Documentation

Seikosha has got it right. Not only is the documentation brief (27 pages), but it is concise and to the point. The manual is laid out in a logical way, and it is easy to digest.

Liberal use has been made of diagrams in the section on getting things set up. The

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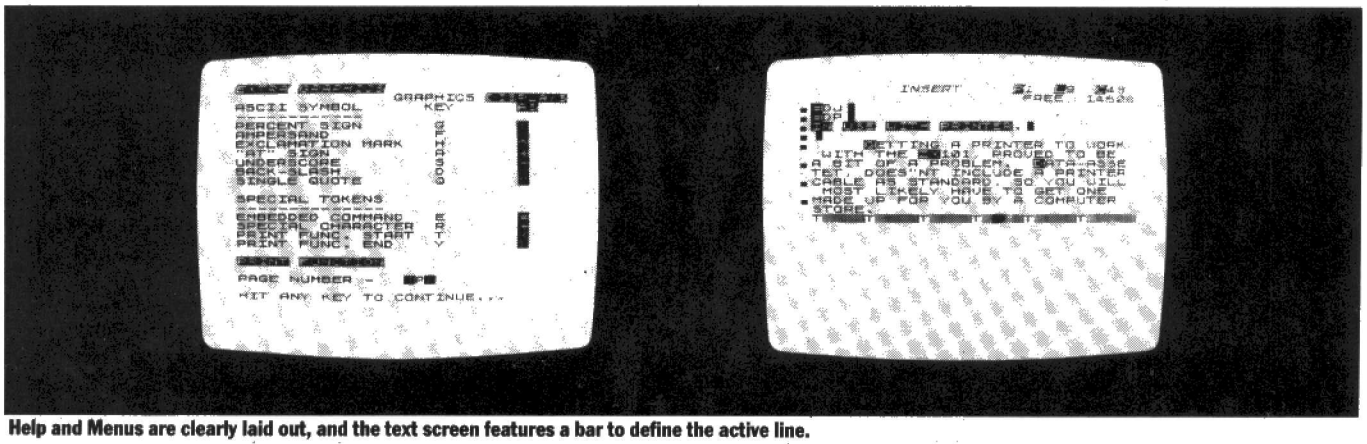


Help and Menus are clearly laid out, and the text screen features a bar to define the active line.

only grumble I have about the manual is that there are no details on maintenance. All you have is a small question/answer troubleshooter table. Some details on how to clean the print hammer would help.

Features

There are not many features, but what's there is impressive. As far as character sets go, the GP100AS has dip switches for country codes to address USA, UK, German and Swedish, with differences such as a pound sign for the hash if the UK set is chosen. These are selected by setting the dip switches within the machine. There is no condensed or italic printing — all you have is software control over double-width characters.

As far as graphics are concerned, there is no extra character set. But you do have full control over the print position and dot position. Each pixel can be addressed individually, so graphic work should not be too much trouble.

For a fuller explanation of how the graphics work, see next week's Pro-Test of the Seikosha GP700A.

Although one shouldn't expect too much for a printer at this price, there were a few features which I believe Seikosha could have included. First, there is no form feed control switch on the control panel, and no software control. If you want form feed you have to program it yourself. The fact that there is no paper-empty warning is of more importance.

In use

Trying to remove the bottom of the printer to get at the dip switches was a real job. But it's worth doing this as the printer has a self-test mode that is selected by the dip switches. Placing the ribbon was quite easy, and took about ten seconds.

Once in operation, you know about it. The noise is rather like a baby's crying, small but loud. Unidirectional printing is done at a steady 50cps, as there is only one print hammer. The printout was fine (7×5), but there was some smearing. Setting the paper thickness didn't seem to cure this.

This is a no-nonsense printer that many will enjoy using. If you've got some money saved up for that £400 printer you saw in the shop window, think twice and get a demonstration of the GP100AS — it may be all you ever wanted.

Top: The GP100AS — no nonsense printing at a good price.
Above: Firmware and RS232 inter face combined.

This is not the sort of system you'd consider using professionally, but this applies to a lot of more expensive WP systems. Although it does all the things it says it does, the problems encountered with the individual components in the system add up to a large reliability problem.

The word-processing firmware tends to generate a messy screen display, and a major problem is that you have to work in upper-case characters all the time. This means that the control sequences involve mentally translating what appears on screen to what will appear on paper.

But the greatest annoyance was the slowness of loading and saving.

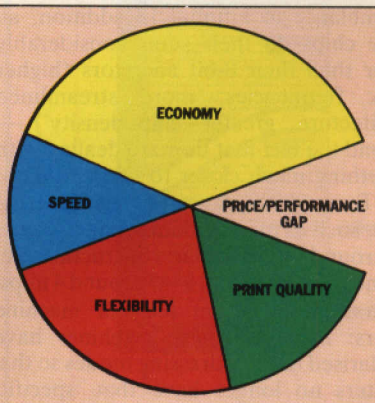
If you're prepared to put up with some aggravation for the luxury of on-screen text handling features at a fraction of the normal price, it represents a good buy.

The printer performed well, apart from noisy printing and the occasional blurred output. To be fair, the Seikosha GP100AS performs to its specifications.

The dot-addressable graphics, however, are very impressive.

When all the components were linked up little quirks tended to rear their ugly heads. Bashing away on the keyboard can jolt the RAMpack or ZX101, crashing the system. Configuring the cable between the ZX101 and the Seikosha was a trauma because of the rather non-standard plugs required.

It doesn't pay to get your typing speed up too high, because the ZX81 tends to lose its breath in the keyboard scanning department.



A high printer capability in one direction will probably cause either a low capability in another or a higher price. Economy is a negative way of expressing price.

If a printer has lots of everything it will close the price/performance gap.

Item ZX101 word processor ROM and RS232 interface **Price** £51.75 **Machine** ZX81 **Contact** Data-assette, 01-258 0409.
Item GP100AS **Manufacturer** Seikosha **Price** £190 to £215 **Speed** 50cps **Interface** 25-pin D type RS232 serial **Contact** DRG 0934-419914.
Item TEC ZX8100 full-travel keyboard **Price** £39.50 plus P&P and six-month guarantee **Interface** ZX81 **Contact** Telford Electronics and Computing 0952-46008.

Francis Monkman looks at the chips that are just that little bit faster and tells the real 16-bit story.

Sweet little sixteen

Don't let anyone (especially computer manufacturers who are propping up tired products and unwilling to do R & D on new and untried technology) tell you that 16 bits really isn't so much better than eight. What you can get for under £50 (if you don't mind building it yourself, and even that's getting simpler, as a chip like Intel's new iAPX186 will show) is every bit as powerful as the processors at the heart of some systems that cost £50,000.

About ten years ago, the first 'computer on a chip' appeared. Intel again, with its 4004 4-bit microprocessor. Four bits isn't very much: you get a number from 0 to 15 to play with, so you're not very relevant to the 'real' world of thundering zeroes crossing the oceans. Eight bits is better, and so the microcomputer was born. You still only get a number from 1 to 255, but you can 'join together' bytes (8-bit data) or even nybbles (4-bit data) to represent any size of data.

Sixteen bits is a different matter. You get a number from 0 to 65,535, which is a much more accurate way to describe the world. (In my own field, music, it means the difference between a sound that is barely acceptable and one which sounds startlingly close to perfection — at the moment).

In the case of machines like Motorola's 68000 and the National 16000 (yes it is a race) which have 32-bit internal, on-chip registers (places to hold numbers), you get a number from 0 to something over 4 billion to work with — which begins to bear a resemblance to infinity! In addition, all these chips do their sums considerably faster than their 8-bit ancestors (higher clock frequencies, more streamlined architecture, greater 'chip density') — beyond the fact that they are dealing with something much closer to lifesized data. The Texas 99000, executing basic instructions, such as moving data around, comes out around 2 mips (million instructions per second), the Fairchild 9445 around 4 mips.

Another important fact for machine coders: many of these machines have regularised their addressing modes so that registers no longer have that 'specific' character so beloved by Z80 programmers.

Here is a roundup, in roughly chronological order:

DEC	LSI-11	**Texas**	9995
Texas	9900	**Fairchild**	9445
Intel	8086	**NatSemi**	16000
Zilog	Z8000	**Texas**	99000
Motorola	68000	**Intel**	iAPX186

These are the main contenders at the moment. There are others that have been announced, but not yet seen. How much do we see? There are companies — Sony for instance — which develop advanced microcomputer chips solely for use in their own products.

LSI-11 Strange that DEC, the microcomputer giant, should have pioneered a technology that now threatens . . . There are lots of excellent things about this, the PDP-11 on a chip (or more accurately, set of chips), and more recent designs show its influence in different ways; but it is now some years old, at a time when the rate of change is accelerating. Even the LSI-11/23, current top-of-the-range, looks somewhat wearied by newer arrivals.

Texas 9900 (figure 1). The beginning of a saga, which continues to unfold. At the time, the 9900 looked to be rather slow, even though it was the first genuine single-chip 16-bit microprocessor. Since then, the Texas personal computer which revolves round it has not been an overwhelming success, to the point where it now sells for a price that makes it charmingly attractive.

The next three chips constitute the backbone of the competition at this stage: Intel, Zilog & Motorola are perhaps the three best-known microprocessor designer/manufacturers, and with the exception of Mostek's 6502 (and possibly the cruising RCA 1802) are jointly responsible for the vast majority of processors currently used in micros.

So, each one's entry into the 16-bit stakes has been watched keenly by enthusiasts, manufacturers and cowboys alike.

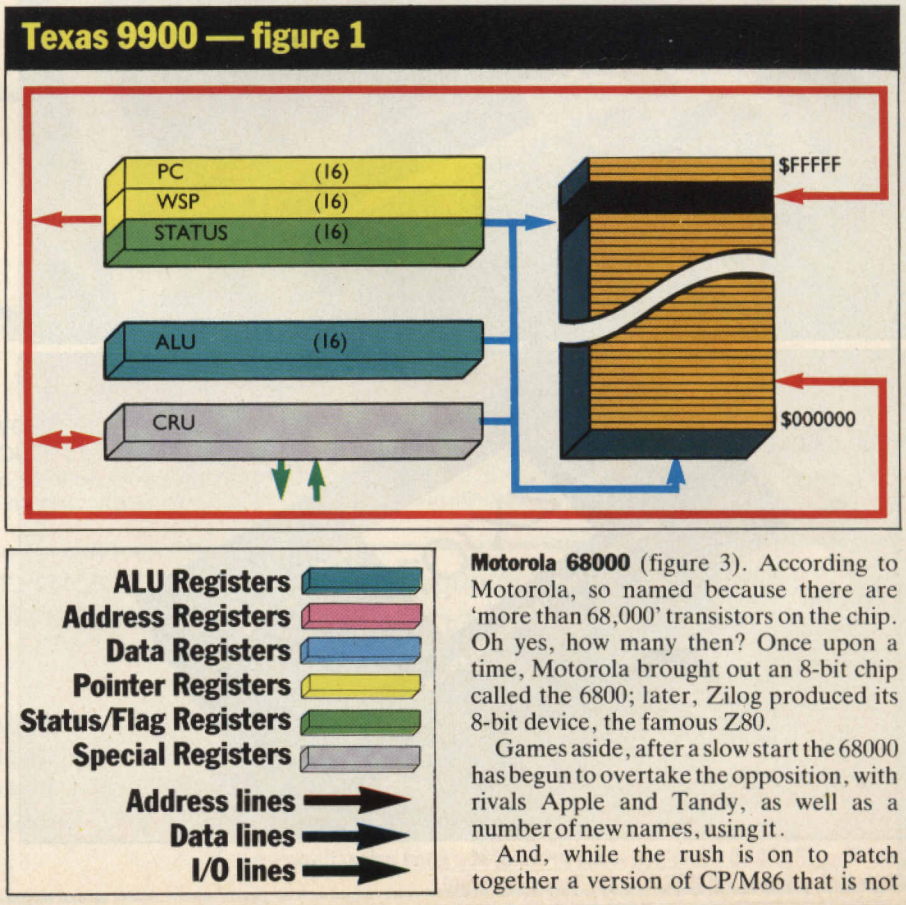
Intel 8086 First off in the 'big beautiful' stakes, the 8086 was the first processor to extend the address lines beyond the 16 common to 8-bit processors (hence 64K addressing limits) to address 1Mb of RAM directly. There are 14 on-chip registers, making this the first microprocessor to look very much like a minicomputer. Being first off, and being Intel, it has attracted much software support, not least from IBM. (IBM, which now owns a chunk of Intel, uses the 8088, an externally 8-bit version of the 8086, in its PC).

But, from here, who can see the winning post?

Zilog Z8000 (figure 2). The Z8000 family actually consists of the Z8001 and Z8002, of which the Z8002 is the simple version. Shades of Z80 logic! The Z8002 addresses the customary 64K of memory; the Z8001 uses 'segmenting' to address 8 Megabytes. Both have 21 registers.

So far Olivetti is the only big name to have opted for the Z8000 in its system; remember, the one on TV which draws its own name slower than all the rest? Bit-power! Commodore has recently signed a deal allowing it to second-source the Z8000 chips, for use in future microcomputers, unfortunately decreasing the likelihood that a '16-bit 6502' will ever come to fruition.

Texas 9900 — figure 1



Motorola 68000 (figure 3). According to Motorola, so named because there are 'more than 68,000' transistors on the chip. Oh yes, how many then? Once upon a time, Motorola brought out an 8-bit chip called the 6800; later, Zilog produced its 8-bit device, the famous Z80.

Games aside, after a slow start the 68000 has begun to overtake the opposition, with rivals Apple and Tandy, as well as a number of new names, using it.

And, while the rush is on to patch together a version of CP/M86 that is not

actually slower than 8-bit CP/M, the Unix/68000 combo is pressing for the 16-bit 'de facto' accolade, with good reason. The 68000 has 19 registers and 24 address lines, directly addressing some 16Mb, enough to make a Winchester hard disk look like main memory! Unlike the hardware-oriented 8-bit chips, which were seen primarily as replacements for logic circuits, the 68000's architecture was drawn up by programmers.

Texas 9995 (figure 4). Meanwhile, back at the ranch, things are proceeding according to plan. The 9995 is an intermediate thrust, benchmarked below by Texas against Motorola's semi-16-bit 6809 and Intel's likewise 8088. The 9995 similarly has an 8-bit external data bus, so it is not strictly a 16-bit machine, even though compatible with the 9900, and considerably faster.

As you can see, the 8088 scrapes a win on one count, but hardly gets a look in elsewhere, while the 6809! . . .

In fact, the 9995 is not much slower than a 68000 running at 8MHz, and costs £12 one off, making it, I am told, an in-house favourite among Texas engineers for developmental purposes. A newly announced Texas Sinclair-lookalike micro, the 99/2, uses the 9995.

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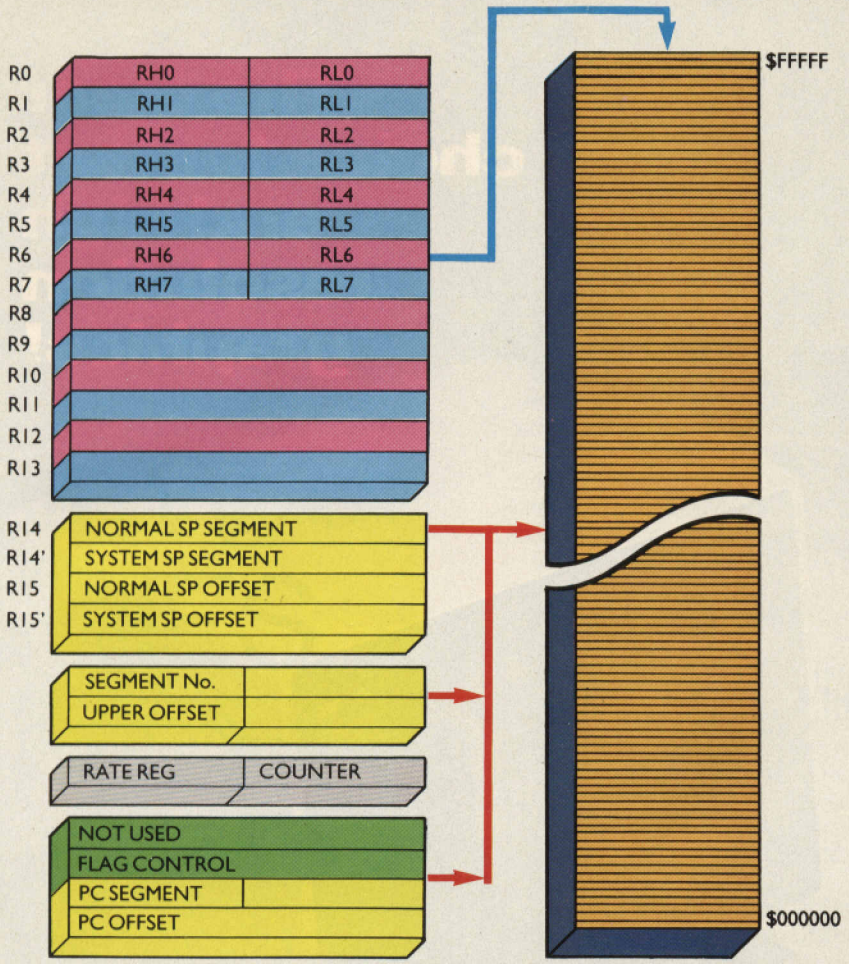
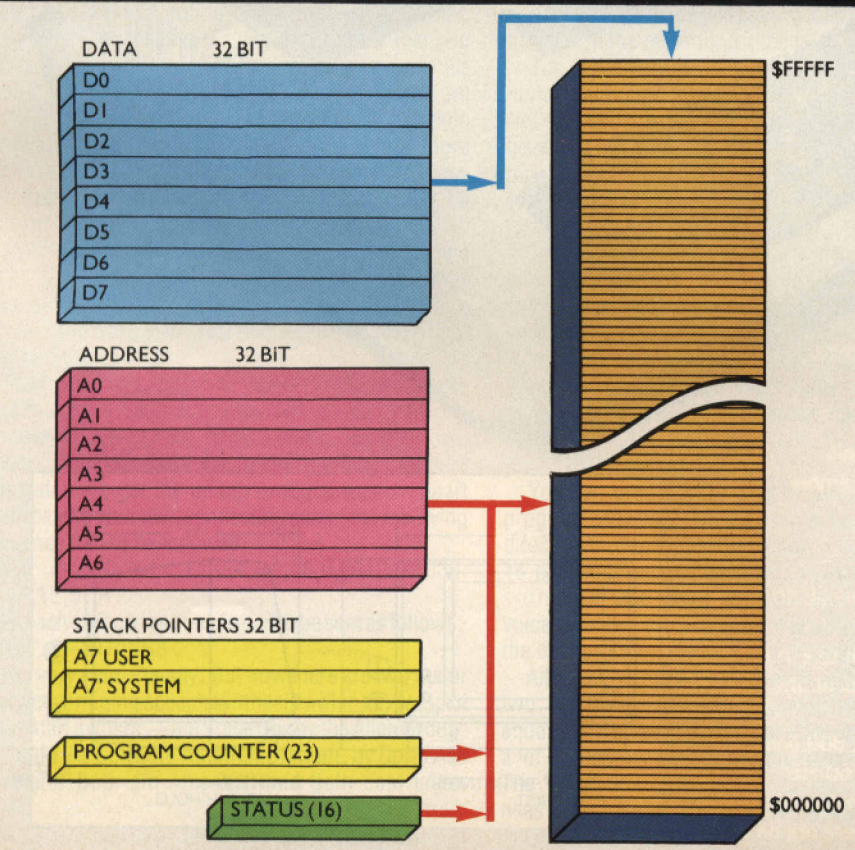
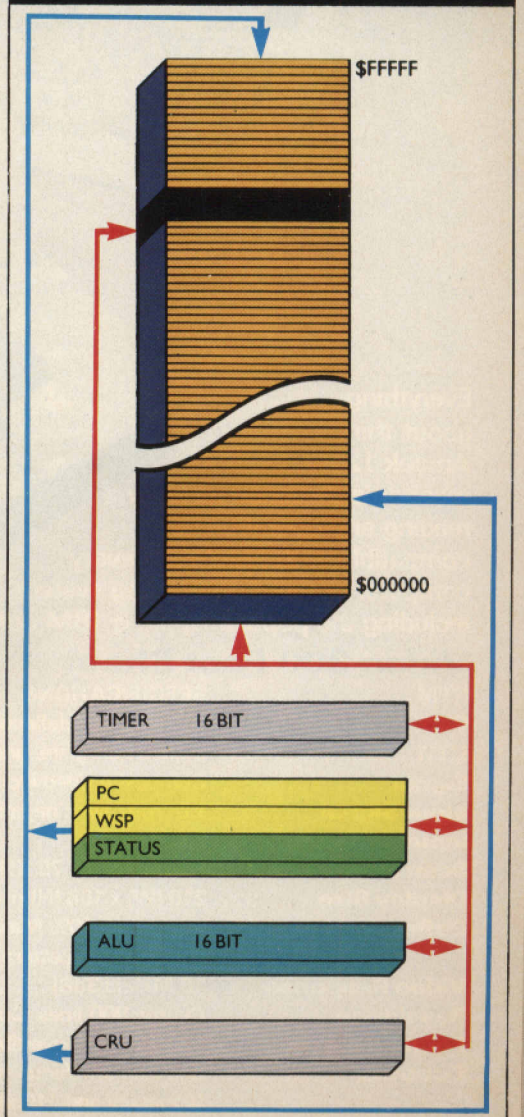
Zilog Z8000 — figure 2



Motorola 68000 — figure 3



Texas 9995 — figure 4



ATARI'S NEW LINES IN CHAT

Sound plays a large part in the enjoyment of computing. Many games have weak concepts but incredible sound-effects or catchy tunes. But sound on the Atari is more than just fun.

When programming on the 400's membrane keyboard the click of the built-in speaker is assurance that a key has been pressed correctly, thus reducing typing errors.

But the Atari can produce something much more useful — speech, which opens up a whole new dimension of computing. How about your Atari 'telling' you when an error has occurred or that you pushed the wrong key — or a voice in a graphics program to eliminate annoying text, giving more room to the graphic display. Perhaps you would like spoken program options instead of a short menu, or more interesting educational programs. Indeed almost any message given to you by the computer could be spoken.

Until now, speech on an Atari has been limited to two main synthesisers — the Echo and the Votrax Type'n'Talk (TNT). These two add-ons were very similar, and produced reasonable quality speech. But they had drawbacks.

They were expensive at about £300, and both required the serial ports provided by the interface module (another £130). They also needed their own power supplies, and could be baffling for the uninitiated. To get the unit to produce speech, apart from making your own connecting cable, the following sequence had to be followed:

```
OPEN #1,8,0,"R1:":X1034,#1,48,0,"R1:":X1036,
  #1,12,0,"R1:"
```

Then each string to be spoken had to be sent as follows:

```
PRINT #1,STRING$
```

Not very user-friendly! But now there are two major products bringing speech synthesis within the grasp of most Atari owners — the Voice Box by the Alien Group, and SAM the Software Automatic Mouth, by Don't Ask Software. Both are American and both cost under £100.

SAM brings a new concept to speech synthesis, in that it requires no additional hardware. The voice is produced entirely by software. Here's the first disadvantage: the SAM program is thirsty on memory. The SAM machine-code routine occupies 9K of RAM. As SAM is available only on disk, a further 8K is taken up by the Disk Operating System.

If you want direct text-to-speech conversion, and not just speech through phonemes, then a further 6K will be used by the reciter text-to-speech converter. This means the SAM package, not including your program, will take about 23K of RAM. But the 8K or so left in a 32K machine is enough for some pretty good programs, like Don't Ask's own Poker SAM.

SAM narrates the entire game, from dealing the cards to keeping count of the money and chatting. Of course he'll laugh at you if he wins. SAM has one other fundamental drawback. Whenever SAM speaks, the screen is turned off. This seems a high price to pay for a little speech, but as most computer speech is only in short phrases, it's normally acceptable.

But the SAM program itself is very good. The speech sounds quite human, and is controllable. You can make SAM stress words in eight different wa[illegible] can control voice pitch and speed, and the package is very easy to use. Once the Reciter program is loaded, the text need only be put in a string called SAM$ and then the statement X=USR(8199) is executed.

Speech can still be obtained without Reciter using phonetics. This method saves the 6K used by Reciter, but does require a little extra work. The 32-page manual is very helpful, giving instructions on how to use SAM in your own programs, and including a list of more than 1,500 phonetic words.

The most attractive thing about SAM is the price. At under £40, as SAM himself says 'talk is finally cheap'.

The Alien Group Voice Box is twice the price of SAM, but is available to any Atari user. The box is a small unit just a little larger than a cigarette box, and has a small knob which varies the speed and the pitch of the voice. It plugs directly into the I/O port on the side of the computer, or into the second port if a disk drive is used. Cassette users will have to load the program and then swop the recorder for the box.

The speech produced by the Voice Box is much less human, although Alien plans to release a Voice box 2. Not only will this have improved speech — it will also be able to sing, although the new box is expected to be much more expensive. The other advantages of the box over SAM include lower RAM usage (less than 16K total) and screen display and speech simultaneously.

The disk includes a 16K and a 32K program. The 32K program includes a face whose lips move in conjunction with the speech, as well as a random sentence generator. This managed to come up with 'The heavy computer eats Lucy'! The text to speech translation is literal, although better pronunciations can be taught to the computer using commands included in the master program. You can also save your own dictionary.

You can program the box by building around the program provided, and you can also control the box directly through machine-code — although the 16-page instruction booklet didn't explain it too well.

There is not much software available using the voice-box, but the Alien group is awarding $5,000 to the best program design using its add-on.

All-in-all, weighing good points against the bad the two synthesisers seem to come out more-or-less equal. SAM gives good speech at a low price, but takes a lot of memory and blanks the screen while talking. The Voice Box gives dullish computer speech, but uses little memory, and doesn't blank the screen. But it does cost nearly £100.

VOLUME 7

A war of words

The SAM disk consists of:

The speech synthesis program. This machine code file automatically loads when the disk is 'booted up'. After the loading procedure, control is handed back to Basic.

The Reciter is the text-to-speech converter program. It is also in machine-code, and is loaded from DOS. Once it's in memory you can enter ordinary text.

The Sayit program is a simple Basic program that requires the Reciter program to be loaded into memory beforehand. The program will accept phonetic or English input.

The Main Demo program. SAM tells a short story about speech synthesisers.

The Speeches program. SAM recites speeches to you.

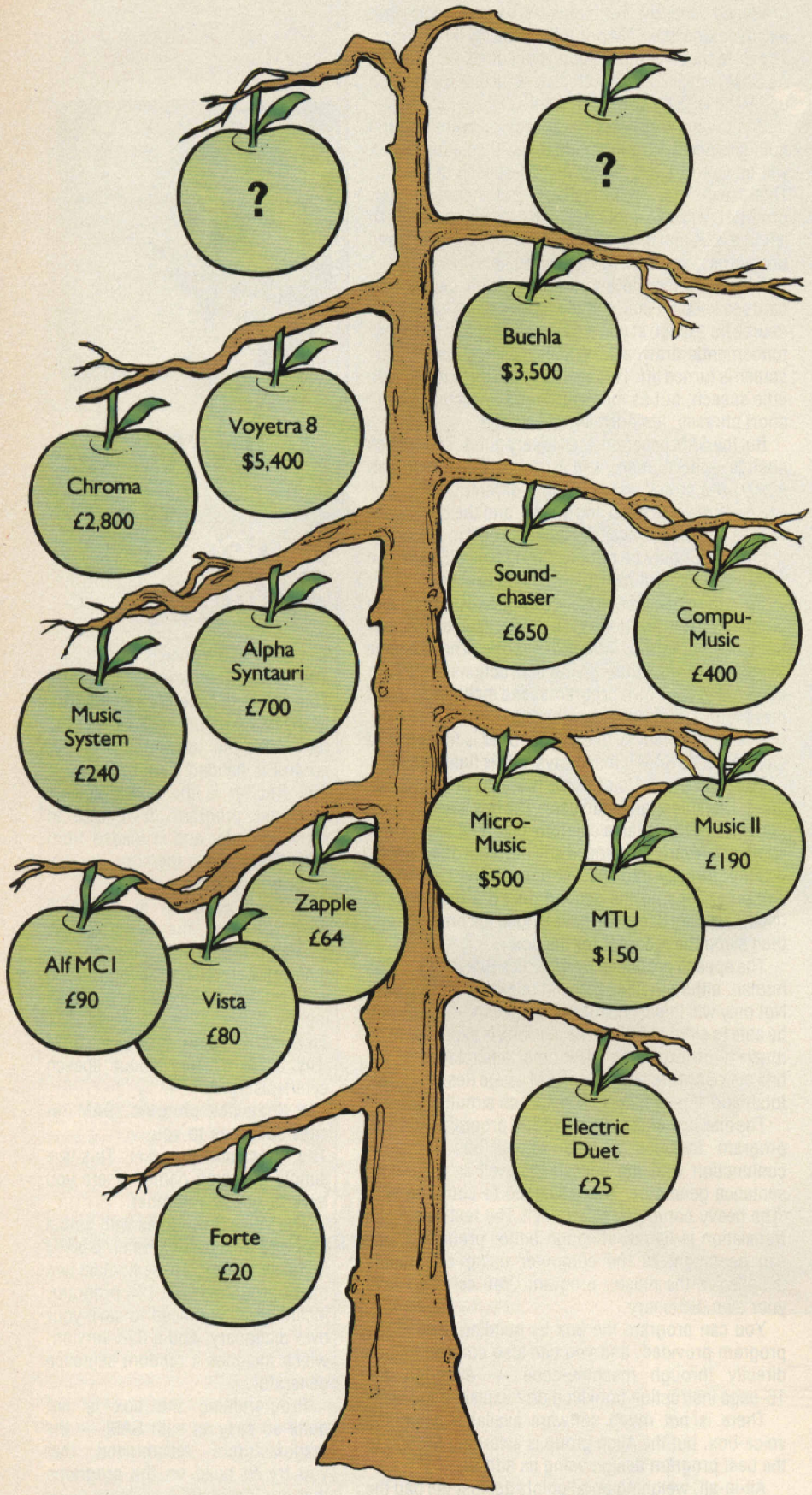
The Guessnum program. This is a simple guessing game, where you have to guess a number.

The Voice Box comes with both a disk and a cassette version packed in the same box. These contain two major programs — a 16K program, including all you need to save your own dictionary, and a 32K version, which includes a random sentence generator.

Programming the box is not quite so easy as with SAM — the manufacturers recommend that you try to build on the programs that are included. A skeleton voice program is included on disk.

The voice box isn't cheap at £99, but it's available to anyone who owns an Atari with cassette or disk of any memory.

SOUND: PART 3



THE APPLE MUSIC TREE

Producing zaps and bleeps galore on the Apple II is old hat. The main problem with the Apple, as far as sonic considerations on the basic machine are concerned, is that it's getting somewhat long in the tooth.

The point is that when the Apple first came out of the garage into a blaze of Californian sunlight, programmable sound generators of the sort used in the BBC Micro, Oric, and Commodore 64 were unheard of. The Apple designers were therefore obliged to opt for rather more mundane circuitry in the shape of a flip-flop that flips (or flops) a speaker's cone via a Darlington amplifier.

However, the major benefit of the Apple's longevity is that a fairly sizable range of music peripherals and software have accrued over the years, and the purpose of this two-part article is to explore the currently available musical offerings.

Starting off at the bottom branch of the Apple music tree, a couple of commercial programs are worth considering as introductions to music synthesis without the expense of additional hardware.

First there's Forte, a monophonic interpreter/synthesiser that excels in its smooth command structure, flexibility, and clear documentation, whereas most ground-level music programs for the Apple are content with POKEing the speaker to produce square waves with monotonous regularity.

Forte incorporates an interesting routine that varies the mark/space ratio of the speaker toggling so that waveforms of different pulse widths, and therefore different harmonic content, can be produced. However, the major limitation of Forte is its monophonic nature.

Electric Duet, on the other hand, goes one stage further by being capable of producing six octaves of duophonic music (*ie*, tune and accompaniment) with a choice of four or more timbres. Note the 'duophonic' tag. With just two toggle states (on and off), it's incredibly difficult to get two notes to sound as if they've been added together.

What's needed for the job is some means of controlling the voltage going to the speaker incrementally, *ie*, degrees of 'on-ness'.

Electric Duet has a very clever trick up its sleeve. A routine within the program generates a high-frequency carrier wave of around 14KHz that's turned on a percentage of time (duty-cycle modulation) according to whether one or the other of the output waveforms is on at any moment. The effect of this is to transmit voltage increments to the speaker without the expense of using a DAC.

As a result, this clever routine turns the 1-bit conversion of the normal speaker toggling into something approaching the waveform resolution possible with a good few more bits. The only caveat to this is that the 14KHz carrier is a bit like a dog whistle for humans — intrusive to those with sensitive ears.

Still, there's also the option of taking the output via the cassette port, which means that the carrier can be filtered out by judicious manipulation of amplifier tone controls, and the resultant sound quality isn't bad.

Music entry into Electric Duet is either by using an editor (which is slow and unfriendly but can be mastered) or by a piano mode on the qwerty keyboard (which is faster but probably unmasterable unless you can amalgamate the skills of a 120 wpm touch-typist with those of Rubinstein).

One further point in favour of Electric Duet is that the player code can be extracted from the editor program and used to play music and sound effects from within your own program — a really nice touch!

Electric Duet is as far as one can reasonably expect

APPLE ACCOMPANIMENT

PERIPHERALS & SOFTWARE: PART 1

to get with the basic Apple. To go further up the music tree, one needs to press extra hardware into service. This means using either a DAC to output sound directly or generate control voltages for running external synthesisers, or a programmable sound generator (PSG) of the TI or General Instruments ilk.

There's a fairly extensive variety of PSG add-ons for the Apple and they're really all much of a muchness. The Alf MC1 is as good as any of them, produces nine square wave voices and three percussion channels spread into a stereo image, and has the major advantage of excellent software for entering music.

Whereas the Alf card uses three Texas 76489 PSGs (the same as in the BBC Micro), the Vista Music Machine uses three General Instruments AY-3-8910s (as in the Oric).

The difference between these PSGs is academic, and the main point is that the Vista card is parasitic on Alf software, *ie* it doesn't come with any of its own. The same is true for other PSG add-ons, including the Super Music Synthesiser, which goes somewhat over the top with 16 PSG voices and quadraphonic sound.

Furthermore, once you start multiplying voices like rabbits, the processor is apt to get bogged down with writing to all the extra registers, and that's not good if the music is fast and complicated or if you're using PSGs for sound effects alongside fast 'n' furious animated graphics.

One British product that has adopted a more rational approach is the Zapple. This also uses the General Instruments chips (up to three), but onboard 'intelligence' takes care of queuing and writing to PSG registers without monopolising processor time.

The excellent software provided with Zapple allows sound tables to be constructed with up to 255 different sounds. These can either be played as sound effects within the context of a game (using a single command from Basic) or used with arrays of music data to play multipart music.

The PSG approach to micro music has a good deal going for it, but both the above PSGs are showing their age (they first appeared in 1979) and there can't be many micro users who aren't tiring of square waves and the limited resolution of frequency and amplitude.

The time is ripe for a new breed of PSG that adds waveform programmability, filtering, and better frequency and amplitude control. In fact, the 6581 Sound Interface Device (SID) in the Commodore 64 goes a fair way to meeting these requirements.

DAC approach

With the digital-to-analog conversion approach to synthesis, one finds the 1MHz 6502 in the Apple struggling to keep up with the demands imposed upon it. The three packages of hardware (DAC boards) and software available for the Apple using this technique all come something of a cropper when it comes to bandwidth, *ie*, the maximum frequency that can be synthesised.

The Micro Technology Unlimited (MTU) system dates from 1979, and the software we're considering (Instrument Synthesis Software) from 1980. Basically, there are two stages to producing music with this software: firstly, the construction of note data (using hexadecimal coding); and secondly, the construction of a sequence of 256-byte waveform tables (using a Construct Waveform Set command which specifies attack and decay envelopes of each harmonic).

The important feature of the software is that it sets up waveform sequencing so that levels of individual harmonics can be changed dynamically from one moment to the next. This mirrors the behaviour of real instruments and natural sounds and, in theory, should result in sounds that are much more musical than the unchanging waveform of the average PSG. In fact, the 6502 is good for looking up waveform tables because of the indirect addressing, but, even so, coping with four parts of music, each with differently evolving waveforms, takes about 128 μs per sample. This 7.8KHz sample rate translates into a practical bandwidth of around 3.5KHz, which isn't exactly of Compact Disc standard! It is possible to produce a passable sound with this software but the insistence on hexcoding makes it highly user-unfriendly.

The Micro Music software seems to use virtually identical software techniques to MTU and shares the same restrictions as far as bandwidth is concerned However, Micro Music has gone way beyond MTU in making its system usable by the average user. Three pieces of software allow entry of music (using non-hex coding or graphics), construction of amplitude envelopes, and — most interestingly — the design and analysis of time-changing timbres by means of a 3-D display of the envelope of each constituent harmonic. Just like the Fairlight CMI, in fact!

Micro Music also produces a huge range of CAI software for its DAC board, including drills for teaching pitch, interval and chord recognition, musical error detection, tune identification, and rhythmic skills. The programs tend to be expensive (averaging $190 each), but one in particular, Sebastian, is a really terrific test of your ability to compare the music that you're hearing with what's displayed in HIRES graphics.

Microproducts' Music II is the third example. The hardware that comes with the package includes a couple of ADCs as well as two DACs, and there's a further bit of software, called Freqout, for sampling sounds and analysing them.

It's not easy to use, however. Music II software outputs sounds with a faster sampling rate than MTU (16KHz), so the bandwidth is somewhat better, but, whereas MTU divides up sounds into 20 waveform segments, Music II makes do with just eight. Also, there are no filters on the outputs of the DACs, which means that quantication noise and so on tends to rule.

A plus point is the music editor which works rather well (though using a musical shorthand code rather than graphics), and the compiler is especially efficient at checking errors and informing the user of blunders.

Next week: *MusicSystem hardware, AlphaSystem and Soundchaser.*

THE SUPPLIERS

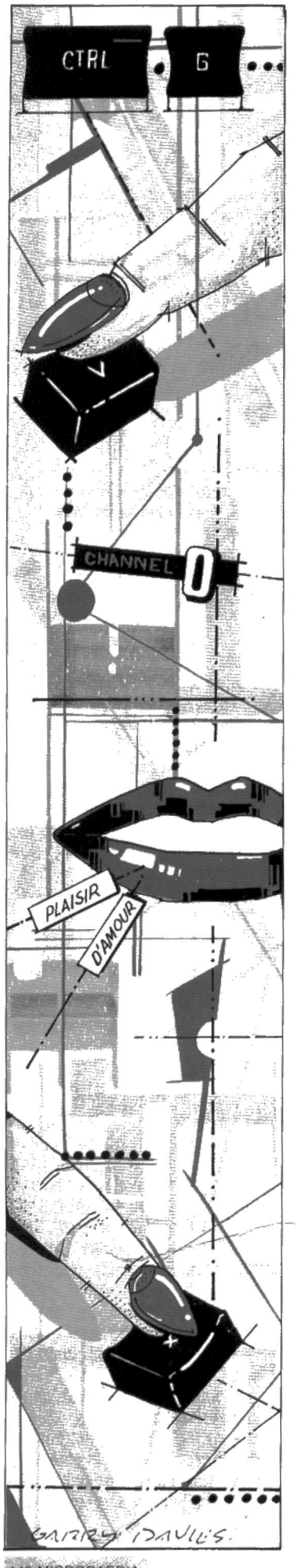
Zapple, Alf, Forte, Electric Duet, MusicSystem and Vista Music Machine
Pace Software, Rose Bank, 130 Clayton Road, Bradford, BD7 2LY (tel: 0274 575973)
Super Music Synthesiser
Applied Engineering, PO Box 470301, Dallas, TX 75247, USA
MTU Instrument Synthesis
Micro Technology Unlimited, 2806 Hillsborough Street, PO Box 12106, Raleigh, NC 27605, USA
Music II/Freqout
Wildport Ltd, 7 Willow Rise, Kirkbymoorside, York (tel: 0751 32308)
Micro Music
Temporal Acuity Products, Inc, 1535 121st Avenue SE, Bellevue, Washington, WA 98005, USA
Compu-Music CMU-800 *(reviewed PCN issue 10)*
Roland (UK) Ltd, Great West Trading Estate, 983 Great West Road, Brentford, Middlesex TW8 9DN (tel: 01-568 4578)
Soundchaser
Triangle Software Ltd, 38 Belleville Road, London SW11 6QT (tel: 01-223 4192)
AlphaSyntauri and Voyetra Eight
Computer Music Studios, 62 Blenheim Crescent, London W11 (tel: 01-221 0192)
Rhodes Chroma
CBS/Arbiter Ltd, Fender House, Centenary Estate, Jeffreys Road, Brimsdown, Enfield, Middlesex EN3 7HE (tel: 01-805 8555)
Buchla 406
Buchla & Associates, PO Box 5051, Berkeley, CA 94705 USA

DAC IN MULTIPLEX

You can multiplex a DAC board, sending control voltages and triggers to external synthesisers, as in the Roland Compu-Music CMU-800 *(reviewed in PCN issue 10)*. This, however, incorporates internal drum sounds (good) and fixed waveform voices (poor).

Basically, notes are entered from the Apple keyboard using Roland's own musical shorthand (pitch, duration and time before next note) and some efficient menu-driven software.

The CMU's major limitation is that it doesn't produce anything like interesting pitched voices unless an external polyphonic synthesiser is added.



NEAT NOTES ON THE BBC

Gone are the days when computers had a simple bleep device for sound. The BBC microcomputer has a sophisticated sound synthesiser system that enables it to produce a wide variety of sounds, and a speech facility is also available. Most of the sounds are produced using just two Basic keywords; SOUND and ENVELOPE. In this part the SOUND command will be dealt with, part 4 will be devoted to the ENVELOPE command.

The easiest way to produce a sound, and also the least well documented, is to press the CTRL key and the letter G simultaneously. The computer will produce a bleep. (The User Guide has invented a new word for this, a beep.) If both are pressed long enough for the key auto-repeat to take effect, a longer bleep will sound.

Strange things happen, as the note now continues after the key is released. This is because the sound generator has its own sound buffer — that is, a memory store for the string of bleeping commands. The key auto-repeat will fill the buffer faster than the sound generator can empty it. The CTRL-G can also be used in programs as it is the ASCII code 7. Therefore a program could have: PRINT CHR$(7). This is equivalent to CTRL-G. Also there is the VDU7 command. Typing VDU7 followed by RETURN will produce the same bleep.

If just a simple bleep is required, say to indicate that a key has been pressed in a program, the VDU command is easier to use than the more complicated SOUND keyword.

Those of you with the new 1.2 Operating System will find that there are some undocumented *FX commands that can be used to alter the pitch and duration of this bleep. *FX213,X changes the pitch. FX214,X changes the duration.

The pitch is the frequency of the note, and the value of X can be anywhere between 0 and 255. The BBC micro sound generator seems to have been designed by a piccolo player rather than by a double-bass player, because the value 4 produces the note C one octave below middle C, and steps of 4 give steps of one semitone in pitch. As the highest value that can be entered is 255, the BBC will cover a range of just over five octaves.

The range of the value of X for the duration is also 0 to 255 — 0 for the shortest duration, 254 for the longest. If the value 255 is given for X, the note will continue indefinitely. A value of 0 gives a note which lasts for one two-hundredth of a second, and other values in the range 1 to 254 give durations measured in twentieths of a second. A value of 10, for example, would give a duration of ten-twentieths of a second, which is half a second.

To produce a note of pitch equal to middle C one second long, enter the following two *FX commands:

```
*FX213,53
*FX214,20
```

Now press CTRL-G to hear the sound. If you want a single-key note, program user-defined key 0 to be *KEY0: G. This has the same effect as VDU7 or PRINT CHR$(7). The default values (the values that are set by the Operating System when the computer is switched on) are 101 for *FX213, and 7 for *FX214.

There is a *FX command to switch the sound off altogether: *FX210,0 switches off the sound generator. *FX210,1 switches it back on.

Before going into the SOUND keyword, a spot of physics is needed to examine what a sound actually is. A note produced by a musical instrument can be described in terms of five factors:

1. Pitch Is the note high or low? Sounds from a piccolo or a woman's voice are higher than that of a double bass or a man's voice. Pitch relates to the frequency of vibration.

2. Loudness is it strong or faint? The scientific term for loudness is amplitude. The vibrations are more violent in the case of a loud sound (high amplitude) than a soft one.

3. Duration How long does the sound last?

4. Quality (or timbre) Is the sound pure or rough? The difference between the sounds of, say, a piano and a harpsichord playing the same note is a difference in quality.

5. Attack How does the sound start, continue and stop? A tape of a piano played backwards sounds quite different because the attack is reversed.

The BBC micro has four sound channels, allowing three separately programmed notes to be played together, and a fourth channel for sound effects. Using the SOUND keyword the loudness, pitch, and duration can be changed. The sound quality and attack are much more complex and are handled by the ENVELOPE command. The SOUND command has the following structure (or syntax):

SOUND C,V,F,D

Here C is the channel: 1, 2 or 3 (or 0 for the special effects);
V is the volume: −15 (loud) to −1 (very soft);
F is the frequency: 0 (low) to 255 (high);
D is the duration: 0 (short) to 254 (long).

The values for F and D are the same as the *FX commands, and D with a value of 255 will give a continuous note. The SOUND command is not over user-friendly — as can be seen above — and the user must remember to make the volume negative. Spaces can be inserted as required in the command.

A one-second note of pitch middle C now using the sound channel one is produced by:

```
SOUND 1, −15,52,20
```

To hear the effect of the volume try the following:

```
10 FOR N=1 TO 15
20 SOUND 1, −N,52,20
30 PRINT "Volume = "−N
40 NEXT N
```

Line 30 was inserted to show how the program finishes long before the sound finishes — the effect again of the sound buffer. The effect of changing frequency can be heard by running this program:

```
10 CLS
20 FOR N=0 TO 255
30 SOUND 1, −15,N,3
40 PRINTTAB (8,12) "FREQUENCY ";N
50 NEXT N
```

Try the following to see the effect of changing duration:

```
10 FOR N=1 TO 30
20 SOUND 1, -15,53,N
30 SOUND 1,0,53,N
40 NEXT N
```

Line 30 has been inserted to provide a pause of the same duration between sounds.

Many effects can be made by varying both the volume and the frequency.

```
10 FOR N=10 TO 255
20 SOUND 1, -(N DIV 16),N MOD 16,2
30 NEXT N
```

To program tunes it is a matter of converting notes into numbers.

The following program plays a scale.

```
10 FOR F=52 TO 96
20 SOUND 1, -15,F,10
30 NEXT F
```

Those with a good musical ear will realise that the simple relationship shown in the user guide and this program does not produce an exact scale. The relationship between the frequency number and the actual frequency, although close, is not exact. This problem will be discussed in more detail in the second part of the article next week. The next program plays the first part of the tune *Plaisir D'Amour*.

```
10 REPEAT
20 READ F,D
30 IF F=99 END
40 IFF=0SOUND1,0,0,DELSESOUND1,—15,F,D
50 SOUND 1,0,0,1
60 UNTIL 0
70 DATA 56,4,80,24,88,24,96,32,0,4,96,4
80 DATA 100,16,100,8,96,12,80,4,96,8,88,32,0,
   4,60,4
90 DATA 68,24,76,24,80,12,88,5,96,5,68,8,88,
   12,100,5
100 DATA 96,24,88,24,80,40,0,4
110 DATA 99,0
```

Data line 110 is the data terminator. Notice the programming technique here. Rather than writing many Sound statements it is much easier to include a loop which reads the frequency and duration from a Data statement. The volume could also be included in the data.

Most home computers with a sound generator could manage the simple tune given above. What is special about the BBC computer is that it is possible to generate three notes at the same time. Try the following:

```
10 SOUND 1, -15,52,200
20 SOUND 2, -15,68,200
30 SOUND 3, -15,80,200
```

This chord is produced by adding a third and a fifth to the note of C (a third is a musical interval corresponding to playing a note two notes higher up the scale, and a fifth corresponds to playing a note four notes higher). This is the simplest kind of chord, called a triad, and is very pleasing to the ear. To turn the BBC into a simple instrument. the next listing enables keys 1 to 8 to produce the eight triad chords of the scale of C.

```
 10 DIM F(13)
 20 FOR N=1 TO 13
 30 READ F(N)
 40 NEXT N
 50 A$ = INKEY$(1)
 60 IF A$="" GOTO 50
 70 A=VAL (A$)
 80 FOR I=0 TO 2
 90 SOUND I+1, -15,F(I*2+A),5
100 NEXT
110 GOTO 50
120 DATA 52,60,68,72,80,88,96,100,108,116,
   120,128,136
```

The following keys give a recognisable tune.

```
3213215443544358876785543 21
```

So far only channels 1 to 3 have been mentioned. There is a fourth channel: channel 0. This channel is a noise channel — for sound effects. The noise produced by this channel depends on the value of the frequency parameter f in the SOUND command:

Value of F	Type of noise
0	High-frequency periodic noise.
1	Medium-frequency periodic noise.
2	Low-frequency periodic noise.
3	Periodic noise set by channel 1.
4	High-frequency 'white' noise.
5	Medium-frequency 'white' noise.
6	Low-frequency 'white' noise.
7	Noise of a frequency set by channel 1.

The first three noises (F=0 to F=3) are rasping, buzzing noises. Values of F between 4 and 6 produce hissing noises of various frequencies. White noise is a special sort of hissing noise made up by mixing a note of every pitch in much the same way that white light is made up by mixing light of every colour. The types of noise can be heard from this program:

```
10 FOR N= 0 TO 7
20 SOUND 0, -15,N,200
30 NEXT N
```

There is not much that can be done to change the nature of the sounds produced when F has a value of 0,1,2,4,5 or 6, apart from altering the volume and duration. However, by changing only these two parameters and combining noises a useful range of sound effects can still be produced.

```
10 SOUND 0, -15,4,2
20 SOUND 1, -15,200,2
```

Similarly, mixing two noise-like sounds produces new effects. So, for example:

```
10 SOUND 0, -15,4,1
20 SOUND 0, -15, 3,1
30 GOTO 10
```

produces a sound like a machine-gun, and the following produces a sound like a laser gun:

```
10 SOUND 0, -15,6,1
20 SOUND 0, -15,1,1
30 GOTO 10
```

Notice that as these examples use the same channel twice, the two sounds follow each other to give a rhythmical pulsing sound. Using this idea with two different pitches of white noise produces a sound very like a helicopter.

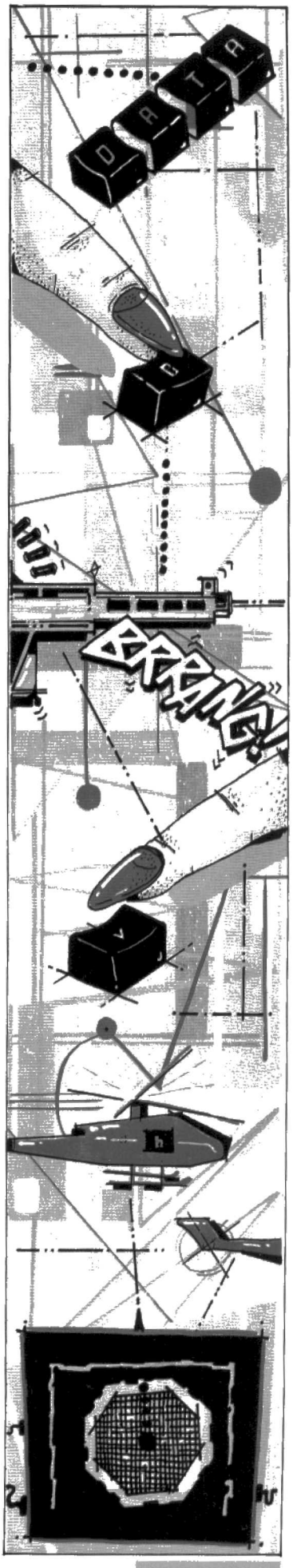
```
10 SOUND 0, -15,4,2
20 SOUND 0, -15,6,3
30 GOTO 10
```

One of the sounds is longer than the other to give the pulsating beat of a helicopter's rotor blades. You can go on experimenting like this indefinitely. The range of sounds produced by channel 0 alone is so great that discovering new sounds is easy. Putting a name to them is quite a different problem.

The frequency values 3 and 7 are special because they produce noises on channel 0 that are controlled by the pitch on channel 1. This enables sound effects to be produced that involve noises which change in frequency. For example:

```
10 SOUND 0, -15,7,125
20 FOR N=125 TO 250
30 SOUND 1,0,N,1
40 NEXT N
```

produces a sound like a spaceship taking off. The frequency of the noise on channel 0 started by line 10 is continuously changed by line 30. Using a volume of 0 means that noises produced by line 30 are silent.



HINTS AND TIPS

When you are programming using speech, you can make the programming and speech quality better, whether you use the vocabulary resident in the speech sythesiser or the Terminal Emulator II.

■ With the TI Extended Basic module, you not only have access to CALL SPGET and CALL SAY, but also several speech separators. The separators, '+', ' ', '–', ',', ';', ':' and '.' can be used as they are in English text. The sentence 'Help, I need you.' sounds more natural if the comma is included after the 'help' and if there is a full stop at the end of the sentence. If these separators are not used, you'll find phrases sound boring because there are no breaks.

■ If you find the words come out too slowly, try using '+' to join two existing words, it may speed things up. Using '+' to join two words can make a new one; 'SIX+TEEN', for example. For really long delays, use multiple separators — spaces more than one are ignored; 'OH,,,OH+NO', for example.

■ The speech synthesiser has a number of preprogrammed phrases as standard. 'GOOD WORK', 'READY TO START', 'WHAT WAS THAT' are a few examples. Using these can save memory and they sound better.

■ Use CALL SPGET as often as possible, especially if you are using words several times within the same program. Keep the CALL SPGETs at the start of the program, before the main body, so there'll be a delay at the start of the program while the speech patterns are assigned to string variables. You can warn of this visually; 'Game is being set up, please wait', for example.

■ Using the speech synthesiser with the Terminal Emulator II gives greater control of how words and sentences are spoken. Though a little more difficult to use, the results are worth the trouble.

■ The pause and break characters, '.', ',', '?' and '!' can be used effectively with the speech synthesiser. They provide breaks in sentences, and some — '!' and '?' — affect the inflection contour of the phrase if a primary stress point has been specified using inflection symbols. The inflection symbols, '^', '—' and '>', change the inflection in a word, '>' shifting stress points within a word.

SEVERAL WAYS TO SAY 99

Speech synthesis is an important man/micro interface. It means an operator in control applications can look at what he is doing instead of having to watch a screen; and because a speech synthesiser would tell the operator what to do, the risk of accidents would be minimised.

It's important, too, for the partially sighted and blind, for speech synthesis can enable them to use computers. And applications are increasing as speech synthesis becomes more sophisticated.

Home computers are an important part of the technological advance. And of these, the Texas Instruments TI-99/4A was one of the first to incorporate speech. Even now, you can upgrade the TI to use allophone data techniques to produce speech, so almost any word can be spoken by the synthesiser — with practice.

But to get the machine to speak, you need hardware and software upgrades, such as the speech synthesiser unit itself, which is attached to the side of the TI. Then there's one of three command modules needed to use and access speech. Figure 1 shows the components needed to produce speech. Briefly, the three are:-

■ TI Extended Basic. An extended Basic within which are added commands needed to access speech; CALL SAY and CALL SPGET.

■ Speech Editor. This module is an editor which facilitates text entry for the speech synthesiser, and 'adds' to TI Basic the Basic commands SPGET and SAY like TI Extended Basic.

■ Terminal Emulator II. This is basically a telecommunications module, but, for the speech enthusiast, it allows you to program the TI to say anything.

As seen in Figure 1, the 'flap' on the TI speech synthesiser is redundant. All the extra vocabularies that were to be produced have now been abandoned since the Terminal Emulator II allows you to produce any speech.

The different ways to achieve speech synthesis cater for both the programmer and the 'ordinary' user. Everone, however, should get the Extended Basic before buying the harder-to-use Terminal Emulator II. Only one module may be used at a time, though each has the functions needed to access speech.

Stored words

As mentioned in the introductory article on TI speech and sound (Micropaedia, Sound, Part 2), the speech synthesiser (as standard) has some 373 words and a few phrases. The words are stored in an EPROM, which is housed in the speech synthesiser. Both the TI Extended Basic and the Speech Editor enable you to access the words in the synthesiser.

The Extended Basic module adds two commands to TI Basic. These are subprograms and must be executed with the call statement. SAS and SPGET can be used in all TI Basic programs as long as the synthesiser is attached. Speech quality is quite good as the 'words' have been pre-programmed.

The speech synthesiser's vocabulary is very standard and includes words for games and computing. Other symbols such as '.', '+' '—' and numbers (0 to 9) are catered for, so to say 'THE ANSWER IS 3.14159' you can enter CALL SAY ("THE ANSWER IS 3.14159) and you'll get, 'three point one four one five nine'.

The program below will display all the letters of the alphabet and the numbers 0 to 9. The TI will also speak the letters and numbers (notice how 'Z' is pronounced).

Program 1

```
10 REM LETTERS AND NUMBERS.
20 FOR A=48 TO 90
30 IF A=58 THEN LET A=65
40 LET A$=CHR$(A)
50 PRINT CHR$(A)
60 CALL SAY(a$)
70 NEXT A
```

The TI vocabulary can be effective and not too difficult. Program 2 is a game to show how speech can be used as a means of output.

Program 2

```
 10 REM GUESSING GAME
 20 RANDOMIZE
 30 CALL SAY ("HELLO, DO U WANT 2 PLAY A
      GAME, YES OR NO.")
 40 INPUT A$
 50 IF A$="NO" THEN CALL SAY ("O+K THEN,
      GOOD+BYE"):: STOP
 60 CALL SAY("THINK OF A NUMBER UNDER TEN
      AND I WILL TRY TO FIND IT IN UNDER FIVE
      GOES")
 70 FOR A=1 TO 5
 80 LET R=INT(RND*9)+1
 90 LET A$=STR$(A)
100 LET B$=STR$(R)
110 CALL SAY("GUESS NUMBER+")
120 CALL SAY(A$)
130 CALL SAY("IS YOUR NUMBER")
140 CALL SAY(B$)
150 INPUT C$
160 IF C$="YES" THEN CALL SAY("I GOT+IT, #I
      WIN#"): : STOP
170 NEXT A
180 CALL SAY("WELL DONE, #YOU WIN# ")
```

The 'How it works' article opposite explains what happens in the game. Yet this is only a small application for speech; there are many others.

Of course, speech synthesisers have a limited vocabulary and you will come across words not included. The only way round this is to use other words.

All examples so far have used CALL SAY. This is by far the easiest way to get the TI to speak. Text can be entered, and providing it is in the vocabulary the computer speaks. But there is a subprogram which obtains the speech pattern for the words to be spoken, for which you use CALL SPGET. This first takes a string, then assigns a string variable with the speech pattern of the word. This is then passed to CALL SAY

for the word to be spoken. For example, CALL SPGET("TWENTY",A$) finds the speech pattern for 'twenty' and assigns it to A$.

The benefit of using SPGET is that the words are spoken more clearly, and quicker. The program below shows this:

Program 3

```
10 CALL SAY("WHICH IS 0+K.")
20 CALL SAY("THIS,")
30 CALL SAY("I AM A COMPUTER.")
40 CALL SAY("OR,")
50 CALL SPGET("I",A$)
60 CALL SPGET("AM",B$)
70 CALL SPGET("A",C$)
80 CALL SPGET("COMPUTER.",D$)
90 CALL SAY("",A$,"",B$,"",C$,"",D$)
```

You can see that using CALL SPGET takes up more room, but the increase in quality is worth the trouble. The speech patterns are made up from all the characters from 1 to 255. To see some with their corresponding words, run the following:—

Program 4

```
10 REM SPEECH PATTERN
20 CALL SPGET("I",A$)
30 CALL SPGET("AM",B$)
40 PRINT "I"
50 PRINT A$
60 PRINT "AM"
70 PRINT B$
80 CALL SAY("",A$,"",B$)
```

For those who do not have a TI, the speech pattern for 'AM' is:

```
" F (M d 4 Jt< -D* nu Y3 DkW hm V 5 KTw
  J Nzl v ; ?"
```

The spaces are for the invisible control codes which are also used to make up a word. Because the string variable is so long for each word, expect delays as the string variable fills up.

Allophones

For real flexibility (literally) in TI speech, there's the Terminal Emulator II command module, which makes it possible to speak any English word.

Figure 2 shows how the entered text is turned into speech. First it is translated into its allphone equivalent using speech rules. Words of the dictionary are not made up by these rules which is why it's hard to learn a language. The allophone strings are converted into Linear Predictive Coding and sent to the synthesiser.

Unlike CALL SAY and CALL SPGET, a file must be opened to get the TI to speak. Text is then entered in a string variable or as a numeric or string literal and sent to the file. Here is an example:—

Program 5

```
10 REM SPEEK
20 OPEN #1:"SPEECH",OUTPUT
30 PRINT "ENTER TEXT TO BE SPOKEN"
40 INPUT T$
50 PRINT #1:T$
60 GOTO 30
```

Words spoken using the Terminal Emulator II sound strange. To get the machine to pronounce 'Ian Scales' — PCN's peripherals editor — correctly, we had to enter 'E AN SCALES'.

Things worsen on very long words because of their pitch and duration in 'real life'. Entering 'monofluorophosphate' (the stuff in toothpaste) caused the machine great difficulty, though putting a space after each syllable corrected things.

The speech synthesiser has features to help you structure words. Both the pitch and slope of a word can be changed by entering into a string '//xx yyy'. *xx* changes the pitch from very high (1), to very low (63). TI recommends that the slope is 32 times 10 per cent of the pitch, as shown here:—

Program 6

```
 10 REM VARIABLE PITCH.
 20 OPEN #1:"SPEECH",OUTPUT
 30 PRINT "ENTER PITCH 0-63 "
 40 INPUT P
 45 LET S=(INT(P/10))*32
 50 LET A$="///"&STR$(P)&" "&STR$(S)
 60 PRINT 1:A$
 70 PRINT "ENTER TEXT"
 80 INPUT T$
 90 PRINT 1:T$
100 GOTO 20
```

Figure 1

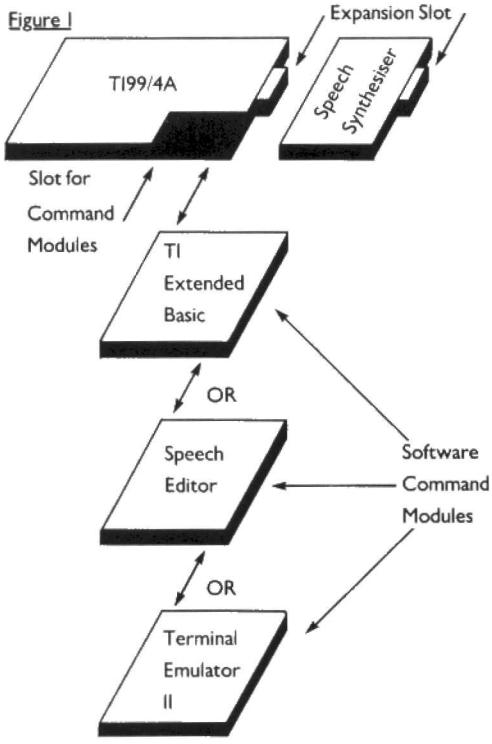
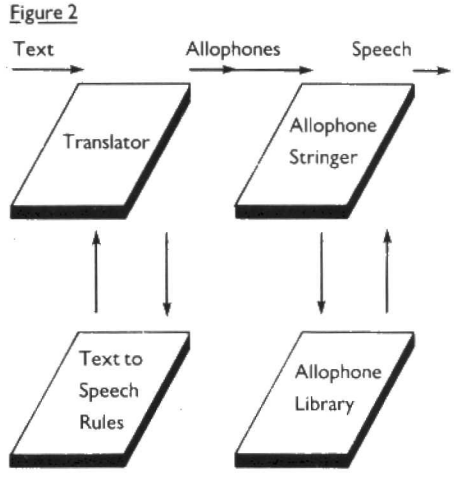


Figure 2



HOW IT WORKS . . .

Program 1

The FOR NEXT loop produces the ordinal number needed for the CHR$ statement in lines 40 and 50. A test is done in line 30 to see if the end of the numbers 0 to 9 has been reached; if so then 17 is added to the loop to achieve the letters.

Program 2

The randomise in line 20 is necessary, otherwise the same random values would occur. The 'U' and '2' in line 30 are quicker than the full words, as the synthesiser takes less time to find them. Lines 90 and 100 use STR$ to convert numbers to strings. There are four consecutive CALL SAYs in the loop because you can't have string variables and string literals within the same CALL SAY.

Program 3

It is not necessary to have a space between each word in a CALL SPGET, a delay will be inserted when CALL SAY is used. The "" in the CALL SAY statement is a means of joining two strings.

Program 4

In lines 20 and 30, speech patterns are moved *into* the string variables. The PRINT statement in line 70 just prints the contents of said variable.

Program 5

Line 20 opens a file (No 1) for the speech to be OUTPUT to. Line 50 merely prints whatever to the specified file.

Program 6

Line 45 computes 10 per cent of the numeric variable P, and this is then multiplied by 32. Line 50 concentrates the necessary string to change the pitch of the voice. This is then printed to the same file as the voice.

In Figure 1 the software command modules contain EPROMs which hold the software necessary for the desired function. Although expensive compared with cassettes, their use enables the software to be accessed immediately.

EXPANDING THE DRAGON'S RANGE

You can get anything from phut! to a roar to Beethoven on your Dragon using software and hardware that's already on the market.

And it needn't cost a fortune, with products from as little as £3.50. Furthermore, being single channel, digital to anologue sound, there are likely to be many hardware add-ons currently in the making that will greatly enhance the Dragon's sound capabilities. The expansion socket, used for ROM and disk drives, can also handle a sound chip. Already there's a sound board available from JCB (Microsystems) which, for £34.95 including postage, gives great sound flexibility.

Called the Dragon Sound Extension Module, it looks like a cartridge and plugs into the expansion socket with no extra wires or plugs. It uses the proven AY-3-8910 sound chip with a 4K EPROM to give three channels of sound with three note chords and harmonies over five octaves.

Two I/O ports are included and the EPROM gives built-in sound effects (such as bombs, lasers, birds) that you can include in your own programs. Unlike the Dragon's built-in sound generator, this module does not cause loss of speed when combining sound and graphics. The user manual which comes with the board includes examples of how to use its 'MUSIC' command in your own programs.

All in all, it's an easy to use and useful product, available from JCB, 29 Southbourne Road, Bournemouth, BH6 5AE.

Taking a different approach is Computavoice, from Dragon Data, which is a software-based voice synthesiser needing no hardware extras. The machine language program is about 8K and is loaded via CLOADM into protected RAM above Basic.

Its vocabulary is effectively infinite since it uses phonetic codes to build words and phrases, rather than draw from a built-in set of words.

Speech is held in a string variable, for example X$, and is spoken by a user call, as in SPEAK=USR0(VARPTR(X$)). As a Basic string can be up to 255 characters, whole sentences can be programmed if you have the patience. The letters A to Z and numbers 1 to 9 are used as symbols for the phonemes, and other characters alter stress and insert punctuation and pauses. To get Computavoice to say 'eight' for example, would use a string holding "/AAYT/".

The cassette includes an example program, though the codes for numbers 1 to 9 in the manual do not exactly match those in the program! However, Computavoice is a good buy at £7.95. The quality of the sound is fairly high (a bit like a Speak'n'Spell machine with a cold) and it has great potential in both games and serious software. You can get the module from Dragon stockists.

One of the cheapest software products is Synth, at only £3.95. Using a mixture of Basic and machine language, the program enables you to create sound via the joysticks, and instructions tell how to include the created sound effect within your own programs. Synth is entertaining to use, but couldn't be described as a serious synthesiser. But at this price who's complaining? It is available from C Woods, 37 Marlpit Lane, Sutton Coldfield, West Midlands.

For anyone interested in converting the works of Beethoven onto their Dragon, the Micro Music Map may be for you. This is a chart which will convert standard sheet music into letters for the Dragon's PLAY command. It requires no real musical knowledge to use it and costs £3.50 from Cotswold Computers, Park Hill, Hook Norton, Oxfordshire.

Another utility is available on the 'Dragon Selection 2' tape by Dragon Data. One of the programs allows you to compose and play back your own melodies with some nice use of graphics included. This program and the other programs on the tape are intended more for the less experienced user — written in Basic and unprotected so they can be examined and experimented with. Selection Two costs £7.95 from Dragon dealers.

Games are getting in on the act, too. Android Attack from Microdeal software is the first of a new generation of games for the Dragon which involve speech synthesis. At the beginning of each game the computer announces 'Intruder Alert' — other phrases include 'Coward!', and 'I'll get you next time'.

The game itself is an adaptation of Beserk. The speech is not as clear as given by the computavoice program, but it does add a nice touch to what is already an excellent game. Talking Android attack is available from Boots or direct from Microdeal.

AN EAR TO THE GROUND

Sound on the Dragon will take a turn for the better when the expanded 32 comes out — it's promised for September. It will have enhanced graphics and an RS232 interface, enabling more companies to produce add-ons for it.

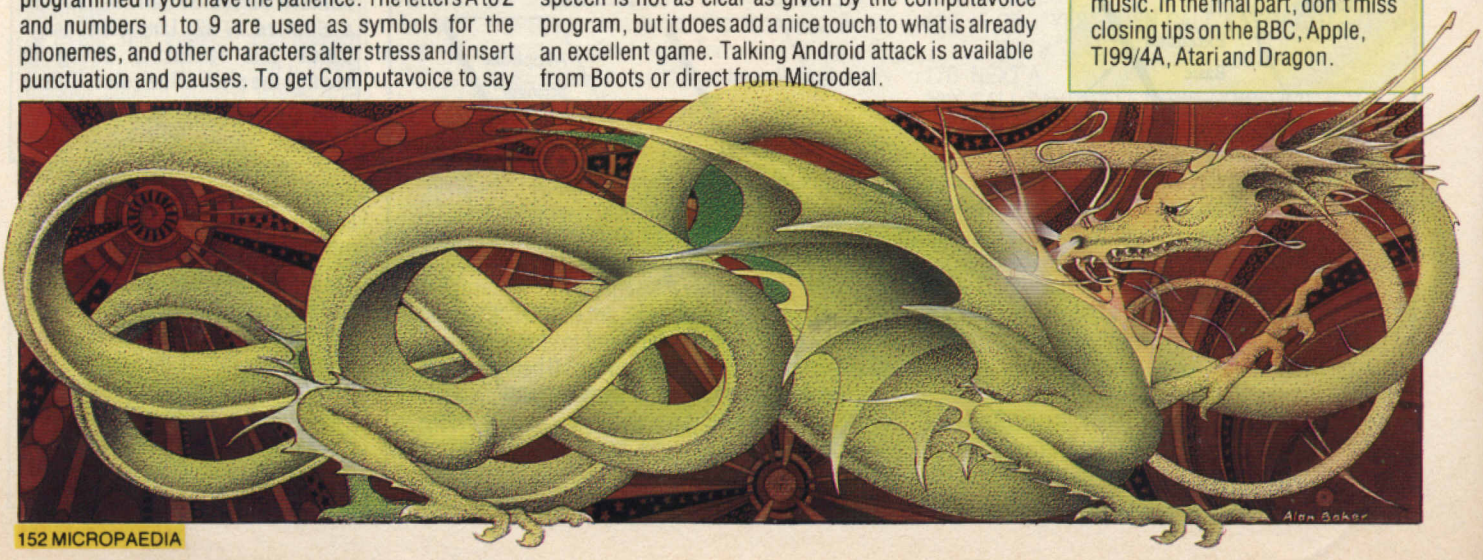
Then there are the disk drives, now some months after the promised date but rescheduled for an end-of-July launch, and 64K upgrade, which should encourage more sophisticated speech synthesis products.

In America, The Voice and stereo sound hardware, as well as the 'talk to me' speech recognition system, have been available for the Dragon's sister machine, the Tandy Colour Computer with disk drives. Thus we can hope for similar products here soon. The Dragon disk drives will cost £275 including DOS and will hold 250K unformatted. The 64K upgrade will cost £75.

Contributors: Brian Cadge, David Ellis, Richard Hawes, David Janda, Martin Phillips
Design: Nigel Wingrove
Illustrators: Gary Davis, Alan Baker

NEXT WEEK

Sound Micropaedia continues in part 4 with more for the BBC Micro, a synthesiser program for the Vic 20, clever ways to tune up your Atari and detailed notes on Apple music. In the final part, don't miss closing tips on the BBC, Apple, TI99/4A, Atari and Dragon.



◀ 43

Fairchild 9445 (figure 5). Fairchild Camera & Instrument Co doesn't publicise this one much, preferring to see it as belonging to a different league altogether. It may be right, and certainly the instruction timings look at least twice as fast as anything else around at the moment.

However, while the 68000 has fallen in price from £150 to £40 in the last year or so, the 9445 will still set you back some £350, which indeed puts it in a different league. Initially, Fairchild brought out the 9440, and immediately found itself in the middle of a legal wrangle with Data General owing to an unfortunate similarity between the two machines. The result was a somewhat sheepish silence, marked by an absence of references to the 9440, which was tacitly agreed never to have existed.

But possibly chagrin is a spur to invention. The 9445 does a neat trick: for machine code freaks only, each 16-bit opcode contains a conditional jump field; *ie*, you can perform a register operation, test the result and jump conditionally, all in one instruction. Also n-level indirection, useful for those who write bug-free code.

This is obviously a machine to be taken seriously, but even though chip development is not an area that lends itself well to promotional sales drives, Fairchild is keeping pretty quiet, preferring to draw attention to its ability to second-source the 16000.

(Anecdote: when Motorola should, one thought, have been congratulating itself on getting the 68000 to work, some many months after its detailed specification had been announced, and amid rumour — it's too complex, they can't get it to work, 98 per cent failure rate, etc — where was its promotional department? Learning about the new chip?)

Well, if you remember, there was a world-wide shortage of memory chips a couple of years ago. Aha! said Motorola, and ordered all hands to memory production. Needless to say, it was just one of those bottlenecks, and soon memory chips were back in plentiful supply. So Motorola decided to plunge its whole promo team into persuading people that what they needed most was lots more memory (of a type they knew perfectly well already).

Meanwhile. the infant 68000 proceeded as best it could, by way of rumour and mud-slinging in the computer press. Experience suggests this to be closer to the norm than otherwise. The 9445, if you can find/afford it, is a good bet for the 'mean and fast' nomination, and if I were American, I wouldn't want to let the Russians have one.

Texas 99000 (figure 6). This one really is neat. While others have been incorporating memory-to-memory facilities on their chips (68000,16000 etc, possibly in the wake of the original 9900) it remains a slow technique on register-based chips. On the Texas chips, the registers themselves really are in memory, and process just as fast as the registers of other chips (faster than many).

You have a 'workspace pointer' which you load with the address of any location in memory; that location, and the 15 following it, are now your register set. And you don't need to worry about saving the register contents to memory, because they're already there! Just change the workspace pointer.

Furthermore, Texas has developed the LSI-11 concept of keeping the actual instruction code (or microcode) separately for updates/expansion/user-defined instructions. Texas does this with a logically separate address space (64K) called 'macrostore'. Macrostore ROM containing floating-point instructions is already available on the TMS99110.

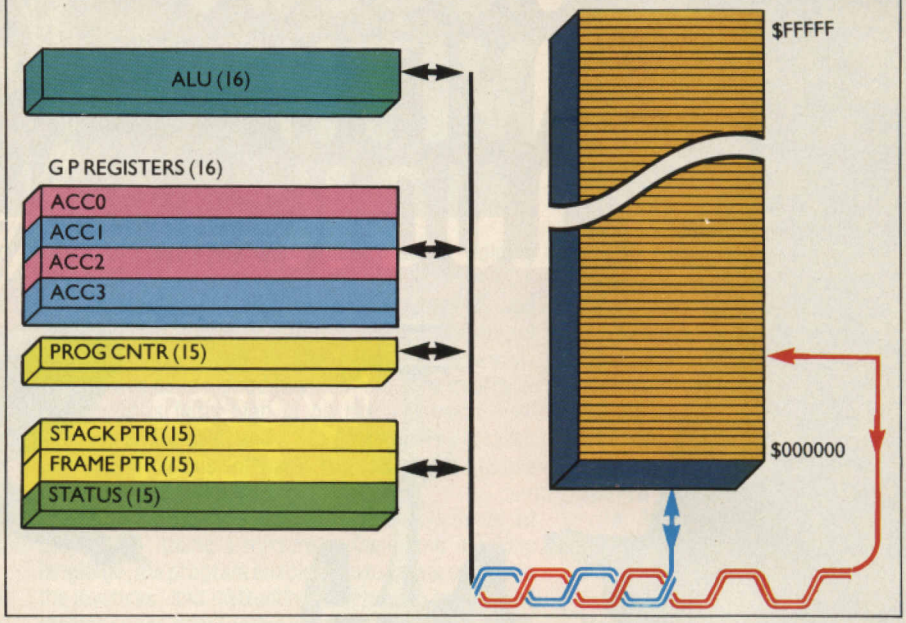
The main advantage of this method is that additional instructions, user-defined or otherwise, will execute at the full speed of the machine.

So if you want to design a high-speed processor and you don't own a wafer plant, hi-tech factories etc, this could be for you.

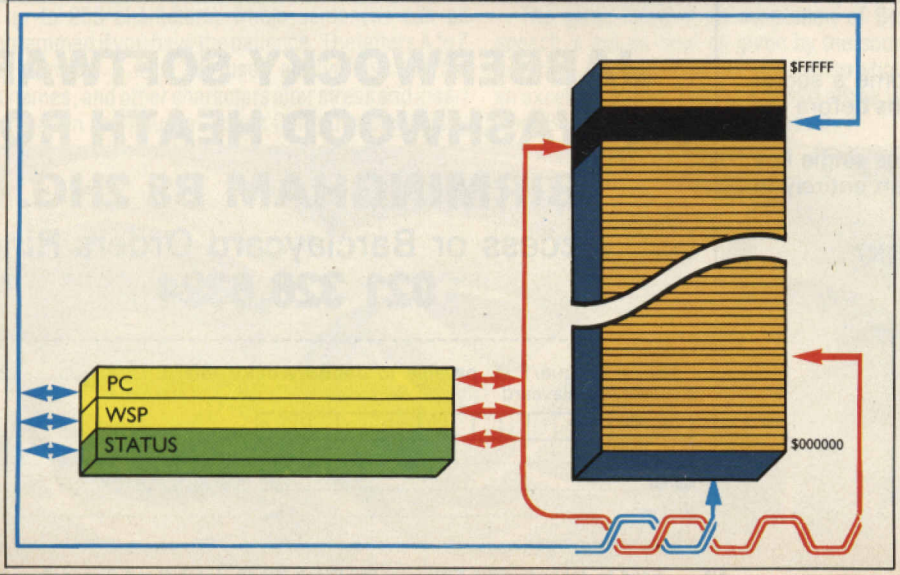
Texas has also implemented an arbitration system called AP (Attached Processor). This means that in multi-processor applications, the main processor can interrogate all other processors if it gets an opcode that it doesn't understand, to see if any of them contains the implementation in its macrostore. All at maximum speed. Response to interrupts, halt and reset signals is almost instantaneous (compare with the 68000, which takes more than 30 clock periods to process the equivalent signals).

The real shame is that Texas's computer department, after catching one cold, has now made its latest machine IBM-compatible (the pseudo 16-bit 8088). Richard King made this point in these pages a few weeks ago, and he informs me he was not then aware of the 99000's existence — perhaps if he had been, his language would have been too strong to print!

Fairchild 9445 — figure 5



Texas 99000 — figure 6



NatSemi 16000 (figure 7). This one has been strongly tipped as the eventual winner, and although it seems to have been unusually long in the cooking, it is now available.

In many ways it resembles the 68000 and seems, perhaps even more so, to have been designed by programmers. Probably the most sophisticated and complicated of the new processors, it includes high-level language support functions. The original blurb talked much about implementing Pascal, which has itself lately been criticised for its sophistication/complication.

In theory, however, this should be the fastest of the 'big is etc' brigade. Some instruction timings appear below, showing a close resemblance to Texas' 99000, a strong contender in the 'mean and fast' category.

In the 16032, the standard 32-bit internal version, it has been heralded as the Beeb's long-awaited 16-bit add-on processor, which means that for many school-age computerists this could be their introduction to 16-bit micros.

My feelings are that it is best to start with something simple, just as I always defend the 6502 against some others as a machine-code beginners processor — although the 16000 certainly doesn't come in the 'some others' category.

One area where the 16000 scores strongly is in its powerful TOS (top-of-stack) addressing mode. This makes it a natural for a Forth implementation which will run virtually at machine level. Like the 68000, the 16000 has a 24-bit address bus; it has 16 registers, and its instructions include string and array handling and block move and compare.

Intel iAPX186 (figure 8). Otherwise known as the 80186, this is a development from the 8086, with which it is largely compatible. This is the really dark horse in the race, and readers are referred to the article in *Byte* magazine, April 1983, for what is perhaps the only readily available information at present.

The main points are that Intel has streamlined areas of operation which represented weaknesses on the 8086. For example, to calculate addresses the 8086 uses the main ALU (Arithmetic Logic Unit) — slow: the 186 has its own address ALU.

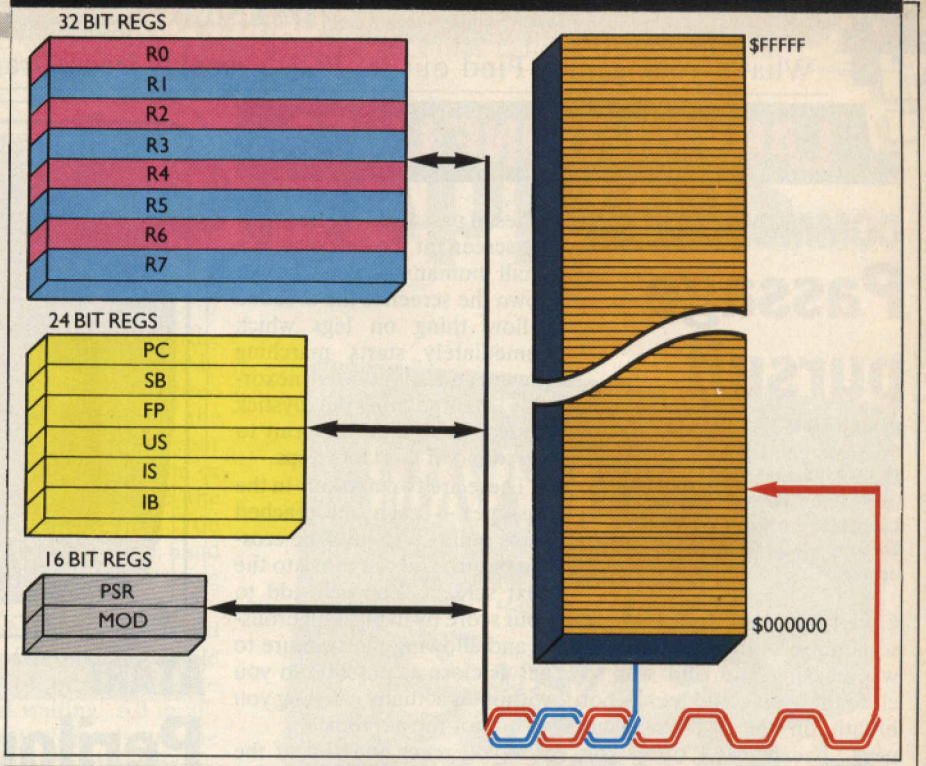
The biggest difference about the 186 is its size, outright winner in a 68-pin package. The good part about this is that logic chips previously necessary to act as interfaces are now redundant, considerably reducing the complexity and cost of system design.

For a basic 186 system all you need is: 1) the chip 2) some TTL latches and 3) memory. Incredibly, the 186 is priced at $30 in the US, according to *Byte*, making it easily the cost-effective winner.

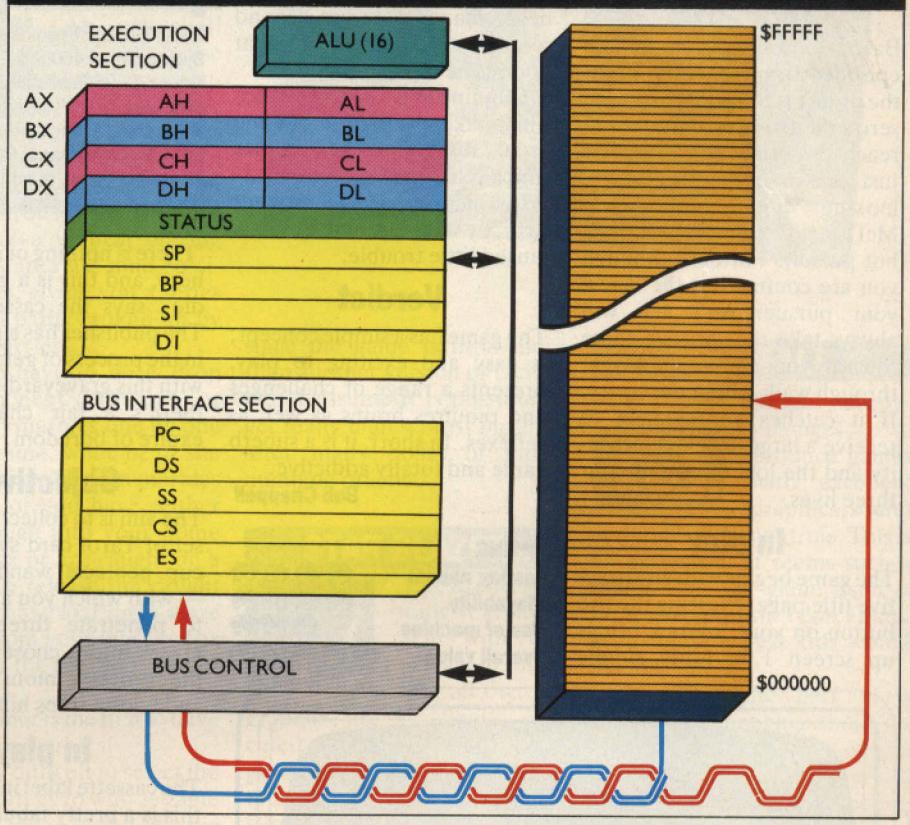
One UK company lauching a 186-based system is apparently having to rely on 8086s at present, owing to the scarcity of the 186.

Theoretically, the iAPX186 should aquit itself admirably alongside the best. Your turn, Zilog.

Natsemi 16000 — figure 7



Intel IAPX186 — figure 8



Summary

Flux is the state of the day, and it is very hard to evaluate some of these machines until systems have been developed round them. But gradually, as makers learn from each other's strengths, certain patterns are emerging; certainly, the new 16-bit chips reveal similarities in different makers' designs that didn't exist between their 8-bit ancestors.

One way to spot the leaders might be to watch whose ideas get cloned most regularly, but by that time the race will have moved on. Suggested further readings: *Sixteen-bit Microprocessors* by Titus, Titus, Baldwin, Hubin & Scanlon (Sams & Co) and the *Microsystems Designers Handbook* (1981) from T I.

In conclusion, let me stress that the significance of the new processors has not yet begun to be felt, and there are some who would minimise it. Precisely at the moment when we are adjusting our thinking to include the revolution that has already occurred, another, quieter one is taking place; one which will place more power in the hands of more people.

LABYRINTHINE LIVES

COMMODORE 64
Passage pursuit

Name Escape-MCP **System** Commodore 64, joystick **Price** £5.99 **Publisher** Rabbit Software 01-863 0833 **Format** Cassette **Language** Machine Code **Other Versions** Vic 20 **Outlets** Mail order, dealers.

Ever had a bad dream where something rather unpleasant was chasing you and was so close that you could feel its hot breath on the back of your neck? Escape-MCP offers you the chance to relive that nightmare, time after time

Objective

Based loosely on one of the episodes from the film Tron, the object is to sprint through a series of twisting passages to reach the other end. There is just one snag — a creature, looking remarkably like a McDonald's sign on legs, is in hot pursuit. Further, although you are confined to the lanes, your pursuer isn't and will always take the shortest route towards you, marching straight through walls where necessary. If it catches you, expect to receive a large dose of electricity and the loss of one of your three lives.

In play

The game begins with an attractive title page. Pressing the fire button on your joystick brings up screen 1, a fairly simple series of passages. At the top of the screen, at the entrance, is a small human — you. Lower down the screen is the dreaded yellow thing on legs which immediately starts marching toward you, silently and inexorably. Manipulating the joystick causes the human to sprint to the sound of loud footsteps.

There are two markers in the passages — each one reached gains points. All must be crossed before you can move to the next screen. You can add to your score by living dangerously and allowing the creature to get as close as possible to you without it actually catching you — not for the nervous.

If you reach the end of the passage, you pass on to screen 2 — much more tricky.

There are nine screens in all. I never managed to get beyond screen 3 so cannot tell you what horrors lie beyond that.

Cunning and logic is needed. This makes it a cut above the usual run of arcade games which rely on reflex action.

Instructions for playing were virtually non-existent but this caused little trouble.

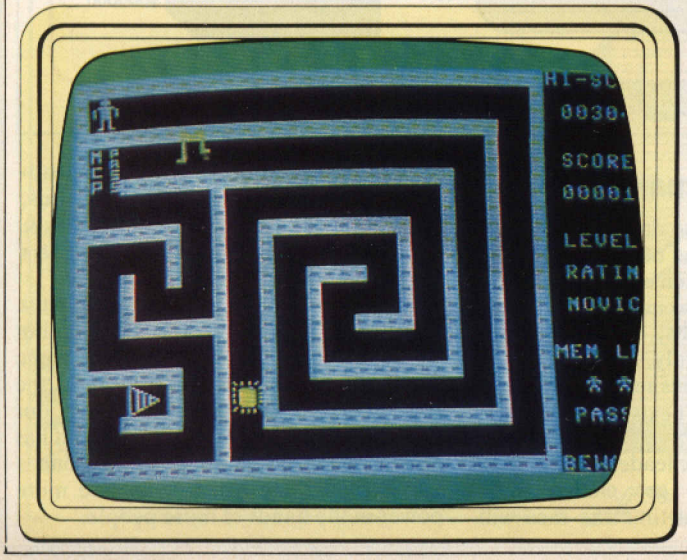
Verdict

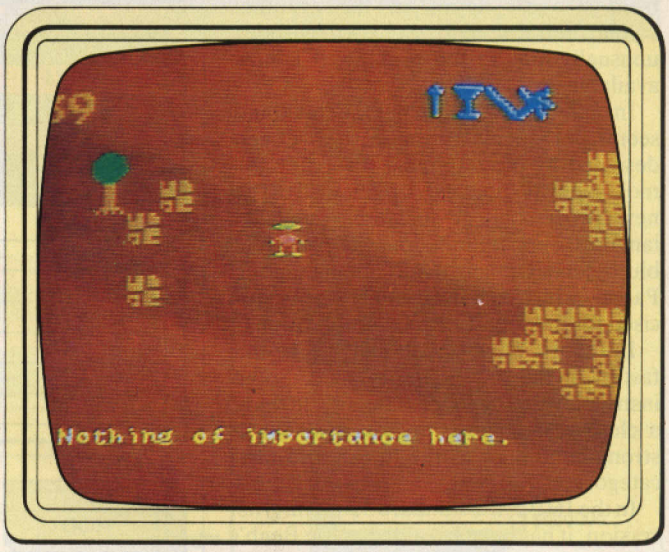
The game has a simple concept, is easy and exciting to play, presents a range of challenges and requires brains as well as reflexes. In short, it is a superb game and totally addictive.

Bob Chappell

RATING

Lasting appeal	
Playability	
Use of machine	
Overall value	





ATARI
Perilous pick-up

Name Escape From Perilous **System** Atari 400/800, joystick **Price** £14.95 **Publisher** English Software Co, 50 Newton Street, Piccadilly, Manchester M1 2EX 061 236 7259 **Format** Cassette **Language** Basic, machine code **Outlets** Atari dealers, mail order.

'There is nothing of importance here, and this is a good day to die,' says the cassette insert. The publisher has a point, since in the process of getting to grips with this graveyard-slow game, there's a fair chance you'll expire of boredom.

Objectives

The aim is to collect a complete set of Tarot card symbols — a cup, pentacle, wand and sword — with which you are required to penetrate three levels of mazes into a chosen room. In the process, monsters attack and booby-traps hinder you.

In play

The cassette label indicates that this is a pretty fabulous adventure. However, I suspect you would get greater thrills out of re-reading an Agatha Christie novel for the fifth time.

You start out in the Gardens of Perilous — lots of trees and lumps of ruined masonry, with the odd sword, cup etc lying rather conspicuously about.

'You' are a little geezer of indeterminate sex in a yellow hat, who walks quite realistically but very, very slowly around in response to the joystick. You have 98 life points at kick-off, which you gradually lose as your enter new rooms, walk into a wall or tree, or get attacked by the demons — Phobos and Deimos.

Phobos, who both munches your life points and dumps you back at the start of your current maze, is a sort of flying purple square. Deimos, who's bothered only about your life points, is a rudimentary dicky-bird. They're exceptionally easy to avoid. Finding your way around is also easy.

You can get killed by doing silly things such as picking up a second sword. They come in light and dark varieties and you aren't supposed to mix the two.

Barring silly errors, you will find a gate through which you trot with your four treasures to the next level. A labyrinth of caves once again filled with swords, cups etc, plus a few goodies such as a lead suit and sets of keys. Oh, and a chest that's booby-trapped, but very obligingly tells you so. There is a radioactive room that's as safe as houses once you have your leaden suit, and so on.

Verdict

A graphic maze adventure is not a bad idea. The problem is that this one just isn't exciting enough. The perils aren't anywhere near perilous enough and the treasures are much too discoverable. The graphics are good as far as they go, but a bit more variety would not come amiss. And most of all, couldn't the hero move a bit faster?

Shirley Fawcett

RATING

Lasting appeal	
Playability	
Use of machine	
Value for money	

It's playtime with the Apple II — Nigel Cross looks at some recently released challengers

A barrel of Apples

In catering for both adults and children the software houses have created endless quantities of spare time entertainment in the form of computer games.

Most Apple games these days have excellent graphics and sound, but the quality of the games varies enormously.

For those of you with a 48K Apple PCN endeavours to give you an insight into the world of graphical ingenuity.

WAVY NAVY

For all the name and the camp boat on the package, this is not one of those limp-wristed games. Wavy Navy is by far the best of this bunch, with its easy-to-follow instructions, brilliant graphics and sound, and it's easy to play and learn. It has ten levels of difficulty (from galley slave through to president) with superb variation in each.

Kamikaze jet fighters, helicopter gunships, mines, bombers and even Exocet-like missiles combine to make this game both fun and difficult to survive. It proved the only one of the selection to have both instant and lasting appeal.

I suggest that you rush out and get it.

QUADRANT

You are required to patrol a shielded quadrant (6112) of the universe containing two stargates. It is through these that the — *yawn* — aliens appear. They are endeavouring to take over the quadrant — you are defending it.

Four classes of enemy attempt to attack you, with increasing points for the more aggressive, plus the alien commander.

This character is the ultimate destroyer; quickly zaps in, rushes round and *splat*, got you. All you've got is an infinitely available laser cannon, but you are also armed with three heat-seekers which are capable of destroying all the aliens in the quadrant as soon as deployed.

A boring game needing three hands to play it, one for the game paddle to control your ship, one to fire the cannon or thruster and one to fire the heat-seeker (space bar). You can use yet another spare hand for the statis field (pause) using 'ESC'.

I found that high scores could be achieved through the simple expedient of moving to one corner and waiting. All in all, not the best of games but the graphics and sound are excellent.

FLIP-OUT

Ah, such relief! A chance to use your brain instead of the normal wrist-breaking zap, splat and pow. In this game the emphasis is on strategy as you slot marbles into and out of a vertical playing area. This area has nine possible layouts, giving you a series of vertical paths broken up by flip-flop barriers.

All you have to do is drop your opponent's (human or computer) marbles one by one into the frame, while he or she does likewise. The ten marbles that each of you have, either drop through into your home marble-box or are caught on a barrier. To release the caught ones, you have to drop in more marbles from your marble-box to activate the flip-flop, and so it goes on.

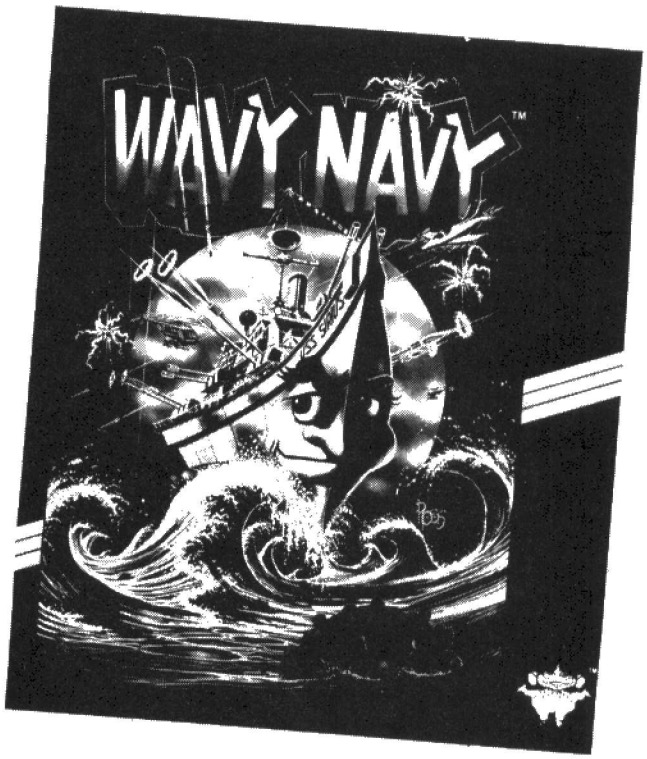
The winner is the first to have got all their marbles!

It's very difficult to select the correct strategy to win. A game worth playing — both addictive and timeless.

REPTON

The best thing about this game is the 'free' iron-on T-shirt transfer. Other than that, the game starts with page after page after page of instructions on-screen which are amazingly complex.

Playing is ridiculously difficult and complex, especially since the game is little more than another version of Defender. I assume it is possible to get really high scores, but only after many hours of mind-numbing practice.



STAR BLAZER

Eyestrain is the only real problem with this all-action game. For all that the graphics are excellently executed the dazzling white background should really have been toned down or at least Broderbund could have supplied a pair of shades.

You, in your star blazer, are supposed to complete a series (five) of increasingly difficult missions. Levelling radar stations, blasting supersonic tanks, destroying IBM (sorry! ICBM) installations until eventually getting the opportunity to bomb the Bungeling Empire headquarters.

Certainly worth a bash, but not up there among the top flight games.

FREE FALL

Sirius always manages to produce games with excellent graphics, sound and convenient controls. This is no exception. It seems such a shame that the game itself is futile and childish. I don't think even the youngest kids would like this one.

You play the part of a steeple-jack hanging about on moving girders and have to drop down to others while gaining points for collecting prizes off passing girders — just like the Generation Game conveyor belt. To make life contrivedly difficult, you are shot at by needles (?), guns and even the odd bomb manifests itself. Not worth the effort!

SBD 15 Jocelyn Road, Richmond, Surrey TW9 1BR 01-8709275 — Wavy Navy £22.50, Flip Out £19.95, Repton £25.50, Star Blazer £23.00, Free Fall £19.95. **Pete & Pam Computers** New Hall Hey Road, Rossendale, Lancs BB46JG (0706) 227011 — Quadrant £21.95.

ADVENTURE

COMMODORE 64

Temple of terror

Names Temple of Apshai, Upper Reaches of Apshai, Curse of Ra **System** Commodore 64 with disk drives **Price** £27.45 for Temple, £13.80 for extensions **Publisher** Epyx Software **Format** Disk **Language** MicroSoft Basic **Other versions** TRS-80, Apple, other microsoft machines **Outlets** Maplin Electronic Supplies, PO Box 3, Rayleigh, Essex. (0702) 554155.

The Temple of Apshai has been billed as the 'computer game of the year'. I took a look at Epyx's new disk version for the Commodore 64.

This, and two additions to the Temple of Apshai saga, Upper Reaches of Apshai, and The Curse of Ra, add up to a pretty fair sample of the new breed of adventure games for the 64.

The Temple of Apshai was one of the first games to attempt to simulate the increasingly popular Dungeons and Dragons type of adventure, and used graphics displays to enrich the action.

The key point about D & D games is that the player must adopt a role, selecting the intelligence, strength, constitution and a name for their character. They then attempt to solve the particular adventure.

Objectives

You can take the character that you define or use one selected for you by the computer. You then do battle against the enemy, who appear with monotonous regularity as you wander through the halls and chambers collecting the treasure.

You can use a wide range of first and second strike weapons, including arrows and shields, elixirs which heal wounds and armour, which comes in very handy in fending off . . . well, antmen and the like.

First impressions

Temple comes in disk form, and comes with an excellent manual. Don't be put off by the size, because reading through will give you a thorough background to the game, and will also give you some valuable hints for faring well.

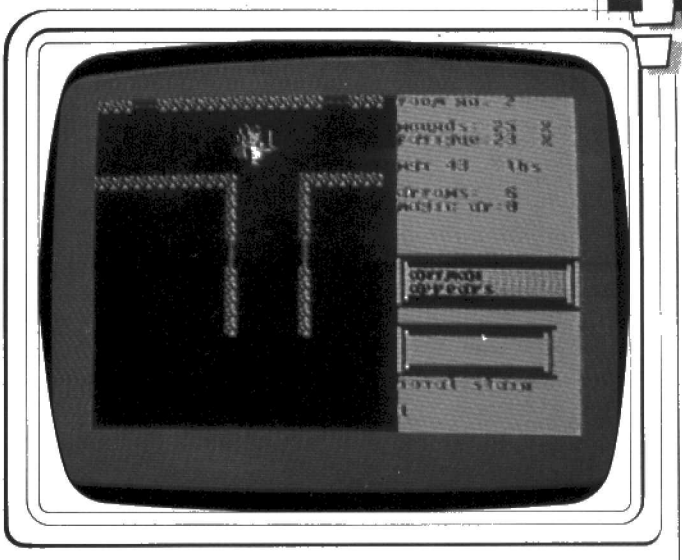
It also contains reasonably detailed descriptions of all the rooms you will find, the enemy that you'll come across, some tips about the kind of environment they favour and how they can possibly be destroyed.

The character set is changed to add to the 'sword and sorcery' atmosphere, and everything is presented in medieval English. You can resurrect a previous character from disk, and games can be saved partway through.

In play

One salient point about Temple of Apshai will come as a shock, particularly if you've neglected to read the manual. It is played in real time, so if you sit back and try to solve a problem logically you may just find a dagger in your ribs.

The use of graphics, while an admirable concept, does little to enhance the game. On the right of the screen is a brief display of your current state, showing strength and fatigue. There is also a space used to reply to any questions you might ask, and one or two other little messages.



Most of the screen is devoted to a display showing you and the walls of the part of the temple that you're currently exploring. It is also used to show any enemy that might be about.

Descriptions of all the rooms are to be found in the manual, so no space (screen or memory) is wasted in repeating it.

When you start play, there are four levels within the Temple from which to choose, each presenting its own particular set of hazards, treasures and rooms.

On my first exploration of the Temple, I managed to kill a number of monsters before falling victim to one of the aforementioned antmen. Quite why, I'm not sure, but random swings of the sword I was carrying appeared to have no effect, although it had been sufficient to dispose of other monsters. Even my arrows, the subject of much bargaining earlier on, did nothing other than sail harmlessly through.

Progress can be singularly erratic, with even the manual telling you that rooms need a lot of exploring and examining.

The treasures to be collected look unnervingly like sand dunes on the screen. The manual usually tells you otherwise, so it's best not to worry about the also have uses other than just being treasures, but I'll leave that to you to sort out. Clue: forget sand — it's nothing to do with egg-timers or builders.

Upper Reaches of Apshai and the Curse of Ra are simple extensions to the existing game, taking you into hitherto uncharted territories, but still leaving you with a mass of treasures to collect, enemy to kill and walls and corridors to explore. Upper Reaches promises you more than 150 new rooms, not to mention gardens, berry patches and caverns, cellars, Benedic's Monastery, and Merlis the Mage's cottage. And you may be lucky enough to get attacked by giant tomatoes or even killer chickens.

They require the Temple of Apshai disk to be used to get the game running, and thus cannot be played by anyone who doesn't already own that program, but as they cost only half Temple's price they're a worthwhile buy if this type of game appeals to you.

Verdict

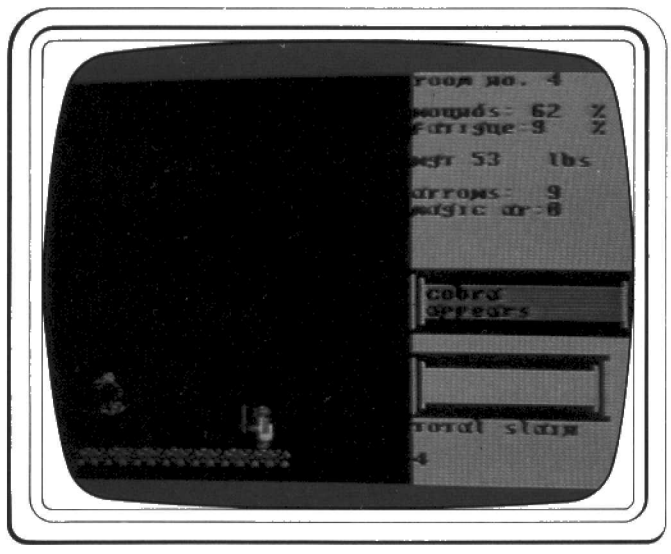
An enjoyable and interesting romp, although hardly worthy of that title of computer game of the year. Better, non-graphical adventures exist, but one must remember that this is a character-epic game rather than a true adventure.

In terms of machine use, it scores quite highly. The graphics are adequate, without being brilliant, but the moody atmosphere created by the subtle use of sound is a strong plus factor. The ability to load and save previous games, characters, and even characters from other dungeon games, is another point in its favour.

Considering the hours of enjoyment (and frustration) that you'll get out of this game, ultimately it's well worth the purchase price. **Pete Gerrard**

RATING

Lasting appeal —
Playability —
Use of machine —
Overall value —



AIRPORT CONTROL

SPECTRUM
Laker faker

Name Airline **System** Spectrum 16K/48K **Price** £5 (16K) £6 (48K) **Publisher** CCS Software, 14 Langton Way, London SE3, 01-858 0763 **Format** Cassette **Language** Basic **Other versions** ZX81, Oric **Outlets** Spectrum dealers, mail order

Some people have fantasies about being a footballer or a pop star, but this game is aimed at those whose desire is to step into the shoes of Sir Freddie Laker and run their own airline.

Objectives

The target is a simple one, to turn £3m into £30m within seven years. Nothing too ambitious. But reach that target and you can then take over British Airways, though a far more likely outcome is the fate that befell Sir Freddie himself.

In play

With no preamble, you're straight into the game and must choose how many aircraft you're going to charter in your first year of operations, not yet having the cash to buy one of your own. A pay-load chart gives you the expected returns on the various numbers of aircraft from one to ten, with a forecast of the charter rates following. Based on these you must decide how many planes to charter.

From time to time, if you have the cash, you will be given the chance to buy a plane. Another factor to decide is the level of insurance cover you're going to have — unless you fancy replacing a DC-10 out of petty cash.

Though only written in Basic, the responses are almost instant, and once you've decided how many crew and maintenance staff to employ the chance elements start to come into play. These include the inevitable strikes. Sometimes you'll discover that you don't have enough crew or ground staff and flights have to be cancelled, losing you revenue.

At the end of a year's trading you will be shown your profit-and-loss account and balance sheet to indicate just how close or far you are from that £30m. Get too far in the red and the liquidator will step in and call a halt to your budding career, and to the game.

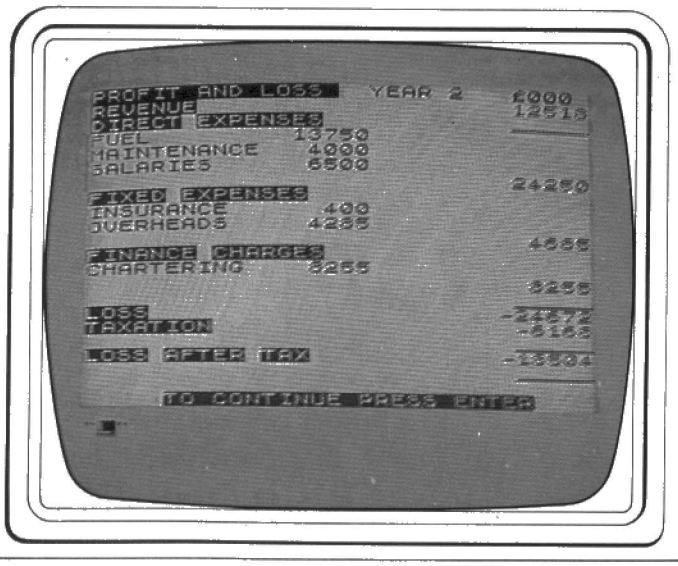
Verdict

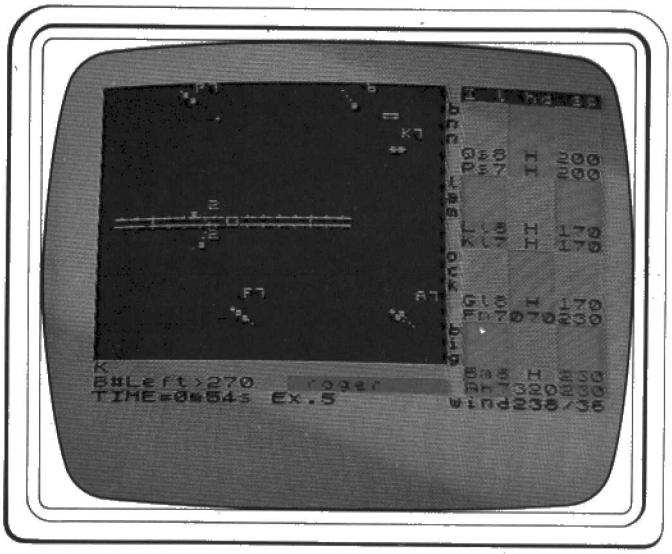
Though I normally enjoy this type of role-playing, I felt that Airline didn't have nearly enough excitement.

A great deal of trouble has gone into making the results authentic, with speedy and complicated financial calculations. However, there is too little input from the player for it to be rewarding. It soon becomes boring, and the prize of a printed message of congratulations or commiserations is rather an anti-climax. This Airline, I'm afraid, doesn't really get off the ground. **Mike Gerrard**

RATING

Lasting appeal	
Playability	
Use of machine	
Overall value	





SPECTRUM
Happy landings

Name Heathrow **System** Spectrum 16K or 48K **Price** £7.95 **Publisher** Hewson Consultants **Format** Cassette **Language** Machine code **Outlets** Dealers, and mail order from 60A St Mary's St, Wallingford, Oxon OX10 0EL.

Anyone who has ever spent hours stacked in a holding pattern over a busy airport should play Heathrow, just to see what air traffic controllers have to put up with. But the satisfaction you'll get from mastering this game is worth every effort.

Every possible variable has been programmed into this game and it's up to you to acquaint yourself with keeping an airport disaster-free.

Objectives

The goal is to land eight aircraft, or as many as possible, in 25 minutes. This sounds simple enough but you must go through a complex series of steps before you can hope to land one.

What's almost as important is keeping track of the detailed information on the screen about each plane's altitude, speed, direction, and classification. Reading the instructions alone takes about half an hour.

And besides coping with aircraft traffic, you've got to be ready for any emergency.

In play

The designers of Heathrow have provided players with a practice program that allows you to familiarise yourself with the blips and bleeps that appear on screen. These make no sense to the novice at first, but by following the very well written introduction, the symbols are soon understood.

Press the V key to stop the action and examine a segment of the game. Pressing W resumes play, and if you want a quick run-through of a typical play sequence you press X and the planes suddenly seem to have received a massive dose of amphetamines.

The first time I tried Heathrow my aircraft, plane F, left the airport's airspace altogether. While the legend 'Plane F has left airspace' flashed insistently I frantically searched the instruction manual to find a way to bring my plane back.

After much trial and tribulation an air disaster was averted.

No matter how carefully you study the instructions there's always a surprise lurking around the corner.

After my introductory session I scored zero in plane-landing but 97 per cent in safety. In other words, poor old Plane 'F' is still up there somewhere.

In keeping with the rest of the game, scoring and overall achievement tabulations are well laid out.

Verdict

Heathrow is not a game to pick up idly and cast aside. It is perhaps annoyingly complex at first but will attract players because its subtleties take a long time to explore. Just don't play if you're planning on flying in the near future. **Steve McClure**

RATING

Lasting appeal	
Playability	
Use of machine	
Overall value	

PCN ProgramCards

It's time again to dust off your keyboard, flex the typing fingers and equip yourself with pots of coffee. Here are the ProgramCards.

This week

A couple of larger programs appear this week. The first is an Atari submission from Les Howarth, of Preston, Lancs. This program for the 400/800 with 32K, Basic and joystick is a very smart version of the old standard Mastermind. Not the Magnus Magnussen version — the board game.

Called Color Code, it will no doubt provoke a few cries of 'not again', but there are a number of redeeming features and variationsfrom the normal style of the game.

The first thing that commands attention about this game is the excellent graphics display using Graphic 10 Mode. Les, of course, is an old hand at this having authored an article on this subject in *PCN, issue 17.*

Many of the techniques demonstrated in the article have been included in Color Code.

Another nice feature is the option of five levels of difficulty from passably simple to ridiculously impossible.

NB: because of the complexity of the graphics characters and highlights that are used in the screen displays, and because the printed listing cannot show inverse print, definitive notes hve been included at the relevant lines.

Our other program this week is from Jane Kennedy, of Edwinstowe, Notts, for the Dragon 32.

Jane's program is a somewhat complex adventure called Wreck. It shouldn't require the brain of an Einstein to realize that that some underwater skullduggery is in store.

Because of the length of the program the final two ProgramCards will be published next week. Just to keep you in suspense.

A RUN for our money

We pay for published programs on a sliding scale which takes into account length, complexity, originality and the programming skill demonstrated in the program. So why not give us a RUN for our money?

As well as the cash, you receive the satisfaction of seeing your byline on the ProgramCard — which will, of course, be snipped out and filed away in the libraries of thousands of micro enthusiasts throughout the country.

Send your contribution, on disk or cassette, together with a plain paper listing and brief summary notes to:

The Programs Editor, *Personal Computer News*, VNU, 62 Oxford Street, London W1A 2HG.

All disks and cassettes will be returned as soon as possible after evaluation or publication, at our expense.

Program panel

PCN has built up a panel of experts for assessing submitted programs.

If you are interested in becoming one of these referees please send details of your experience and specialities, mentioning expertise in any particular machines, to the Programs Editor at the address given above.

PCN ProgramCards

Colour Code Card 1 of 5

8319CC1/5

Atari 400/800
Atari Basic

Application: Game
Author: Les Howarth

An interesting Mastermind-type game featuring five levels of difficulty and excellent graphics. NB: Where '£' is printed type '#'. Also take heed of inverse character notes.

```
10 DIM PL$(5),A$(40),B$(24),B(5),B1(5),C(5),D(5),Q(3),HUE(9):POKE 764,255:GOSU
B 1120:OPEN #1,4,0,"K:"
20 GM=0:SC=0:GOSUB 1400:GRAPHICS 10:GOSUB 820
30 RESTORE 940:FOR I=704 TO 712:READ A:POKE I,A:HUE(I-704)=A:NEXT I:COUNT=10:L=2
2:PP6=21:IF GM=0 THEN 170
40 COLOR 8:PLOT 6,0:DRAWTO 58,0:DRAWTO 58,176:DRAWTO 6,176:DRAWTO 6,0
50 FOR I=16 TO 160 STEP 16:PLOT 6,I:DRAWTO 58,I:NEXT I:PLOT 40,0:DRAWTO 40,176
60 PLOT 64,32:DRAWTO 72,32:DRAWTO 72,46:DRAWTO 64,46:DRAWTO 64,32
70 COLOR 7:FOR I=33 TO 45:PLOT 65,I:DRAWTO 71,I:NEXT I
80 COLOR 4:PLOT 65,56:DRAWTO 65,70:DRAWTO 67,70:PLOT 69,56:DRAWTO 69,70:PLOT 71,
56:DRAWTO 71,70:PLOT 70,63
90 RESTORE 960:W=20:FOR I=1 TO 5:READ B$:POSITION 0,W+1:? £6;B$:NEXT I:W=36
100 FOR A=1 TO 9:FOR I=1 TO 5:READ B$:POSITION 2,W+I:? £6;B$:NEXT I:W=W+16:NEXT
A
110 RESTORE 1070:FOR I=1 TO 5:READ B$:POSITION 60,80+I:? £6;B$:NEXT I:RESTORE 10
60-(DIF*10):W=94
120 FOR I=1 TO 5:READ B$:POSITION 67,W:? £6;B$:POSITION 67,W+1:? £6;B$:W=W+2:NEX
T I
130 RESTORE 1080:FOR I=1 TO 5:READ B$:POSITION 60,4+I:? £6;B$:NEXT I
140 RESTORE 1090:FOR I=1 TO 5:READ B$:POSITION 60,130+I:? £6;B$:NEXT I:POKE 1538
,8
150 RESTORE 1100:W=1:FOR I=1 TO 5:READ B$:POSITION 7,180+W:? £6;B$:POSITION 7,18
1+W:? £6;B$:W=W+2:NEXT I
160 W=1:FOR I=1 TO 5:READ B$:POSITION 30,180+W:? £6;B$:POSITION 30,181+W:? £6;B$
:W=W+2:NEXT I
170 GOSUB 750:GOTO 440

180 IF STRIG(0)=0 THEN 180
190 IF DIF>3 THEN 230
200 J=1+(Z>74)+(Z>86)+(Z>98):K=6*J+7:COLOR SEL:PLOT K,L:DRAWTO K+2,L:PLOT K,L+1:
DRAWTO K+2,L+1:PLOT K,L+2
210 DRAWTO K+2,L+2:PLOT K,L+3:DRAWTO K+2,L+3:PLOT K,L+4:DRAWTO K+2,L+4
220 C(J)=SEL:RETURN
230 J=1+(Z>68)+(Z>80)+(Z>92)+(Z>104):K=6*J+4:COLOR SEL:PLOT K,L:DRAWTO K+2,L:PLO
T K,L+1:DRAWTO K+2,L+1:PLOT K,L+2
240 DRAWTO K+2,L+2:PLOT K,L+3:DRAWTO K+2,L+3:PLOT K,L+4:DRAWTO K+2,L+4
250 C(J)=SEL:RETURN
```

10-30	Define arrays, initialise display, set graphics mode, load colour data, display title page with sound
40-160	Display playing screen format using defined character strings
170	Perform score initialisation, jump to code generation
180-250	Routine to place each selected peg and colour on playing area, used by 580. Selection put in array C(*)

Color Code Card 2 of 5

8319CC2/5

```
260 GOSUB 410:WIN=0:FOR I=1 TO 4+(DIF>3):D(I)=0:B1(I)=B(I)
270 IF B1(I)=C(I) THEN D(I)=3:WIN=WIN+1:C(I)=10:B1(I)=50
280 NEXT I:W=1:IF WIN=4+(DIF>3) THEN 340
290 FOR I=1 TO 4+(DIF>3):IF B1(W)=C(I) THEN D(I)=6:C(I)=20:B1(W)=75:GOTO 310
300 NEXT I
310 W=W+1:IF W<5+(DIF>3) THEN 290
320 IF DIF=1 THEN 350
330 FOR I=1 TO 4+(DIF>3):R=INT(4*RND(0)+1):W=D(I):D(I)=D(R):D(R)=W:NEXT I
340 IF DIF>3 THEN 370
350 FOR I=1 TO 4:K=41+I*3:COLOR D(I):FOR W=PEG TO PEG+4:PLOT K,W:NEXT W:NEXT I:I
F WIN=4 THEN 510
360 GOTO 380
370 FOR I=1 TO 5:K=40+I*3:COLOR D(I):FOR W=PEG TO PEG+4:PLOT K,W:NEXT W:NEXT I:I
F WIN=5 THEN 510
380 Y=Y+16:PL$(Y,Y+40)=A$:L=L+16:PEG=PEG+16:COUNT=COUNT-1:IF COUNT=0 THEN GOTO 5
10
390 FOR I=1 TO 5:C(I)=0:NEXT I
400 GOTO 580
410 SOUND 0,PEEK(20),10,8:FOR I=1 TO 20:NEXT I:SOUND 0,0,0,0:RETURN

430 X=INT(7*RND(0)):RETURN
440 IF DIF>3 THEN 480
450 FOR I=1 TO 4
460 GOSUB 430:IF DIF<3 AND X=0 THEN 460
470 B(I)=X:NEXT I:GOTO 570
480 FOR I=1 TO 5
490 GOSUB 430:IF DIF<5 AND X=0 THEN 490
500 B(I)=X:NEXT I:GOTO 570
510 POKE 53249,0:IF DIF>3 THEN 530
520 FOR I=1 TO 4:COLOR B(I):K=74+I*6:GOSUB 550:NEXT I:GOTO 540
530 FOR I=1 TO 5:COLOR B(I):K=4+I*6:GOSUB 550:NEXT I
540 SC=SC+COUNT*DIF*2:GOSUB 770:GOTO 1570
550 PLOT K,6:DRAWTO K+2,6:PLOT K,7:DRAWTO K+2,7:PLOT K,8:DRAWTO K+2,8
560 PLOT K,9:DRAWTO K+2,9:PLOT K,10:DRAWTO K+2,10:RETURN
570 RESTORE 920:READ I:SEL=6
580 ST=STICK(0):H=0:V=14:IF STRIG(0)=0 THEN GOSUB 410:GOSUB 180
590 IF PEEK(764)=33 THEN POKE 764,255:GOTO 260
600 IF PEEK(53279)=6 THEN POKE 53249,0:GOTO 1630
610 IF ST=15 THEN 580
620 H=H+(ST=7)-(ST=11)+(ST=6)-(ST=10)+(ST=5)-(ST=9):Z=Z+H*12
630 IF ST=14 OR ST=13 THEN SEL=SEL-(ST=13)+(ST=14):GOTO 710
640 IF DIF>3 THEN 680
650 IF Z>110 THEN Z=110
660 IF Z<74 THEN Z=74
670 GOTO 700
```

260-360	Routine to test each selected peg for scoring up to 4 or 5 pegs with randomising of correct pegs for levels 2 to 5
370	Routine to display black, white or 'no result' pegs
380	Routine to move to next attempt line
390-400	Routine to clear selection array and go to next attempt
410	Routine to produce sound based on timer at location 20
430	Randomise routine used in following routine
440-500	Routine to select hidden code
510-560	Routine to display hidden code on game end
570	Reset colour data
580-670	First part of routine to allow selection of each peg using joystick. UP/DOWN = colour select. LEFT/RIGHT = position select. FIRE = put in place. SPACE = end attempt. START = new game.

PCNProgramCards

Color Code Card 3 of 5

8319CC3/5

```
680 IF Z>116 THEN Z=116
690 IF Z<68 THEN Z=68
700 POKE 53249,Z:GOTO 580
710 IF SEL<0 THEN SEL=6
720 IF SEL>6 THEN SEL=0
730 F=HUE(SEL)
740 POKE 711,F:FOR W=1 TO 20:SOUND 0,200,12,8:NEXT W:SOUND 0,0,0,0:GOTO 580
750 IF GM>0 THEN RETURN
760 FOR A=63 TO 71 STEP 4:K=A:RESTORE 1060:GOTO 800
770 D(1)=INT(SC/100):D(2)=INT(SC/10)-D(1)*10:D(3)=SC-(D(1)*100)-(D(2)*10)
780 K=71:F1=1:IF SC>9 THEN K=67:K1=2:IF SC>99 THEN F=63:K1=3
790 FOR A=K1 TO 1 STEP -1:DS=D(4-A):RESTORE 1060+(DS*10)
800 W=1:FOR I=1 TO 5:READ B$:POSITION K,150+W:? #6;B$
810 POSITION K,150+W+3:? #6;B$:POSITION K,150+W+4:W=W+4:NEXT I:W=1:K=K+4:NEXT A:
RETURN
820 PL$(1)="*":PL$(512)="*":PL$(2)=PL$:A$="[16*] [CTRL/INSERT] [&INV/CTRL/A]
[CTRL/INSERT] [16*]"
830 I=PEEK(106)-40:POKE 54279,I:POKE 53256,1:POKE 53277,3
840 VTAB=PEEK(134)+PEEK(135)*256:ATAB=PEEK(140)+PEEK(141)*256:OFF=I*256+1300-ATA
B
850 HI=INT(OFF/256):LO=OFF-HI*256:POKE VTAB+2,LO:POKE VTAB+3,HI
860 GOSUB 900
870 RESTORE 930:FOR I=0 TO 10:READ D:POKE 1536+I,D:NEXT I:POKE 512,0:POKE 513,6
880 DL=PEEK(560)+256*PEEK(561)+4:POKE DL+180,143:POKE 54286,192
890 RETURN
900 FOR I=174 TO 17 STEP -1:PL$(I,I+40)=A$:NEXT I:POKE 559,62:POKE 623,190:Y=17:
PL$(Y,Y+30)=A$:POKE 53249,Z
910 RETURN
920 DATA 8,54,116,0,198,250,14,14,18
930 DATA 72,169,220,141,10,212,141,21,208,104,64
940 DATA 233302330203002302303,230302303023303,233002330023030230233033
950 DATA 230302303023330230233033,230302303023030230233033,233302303023030230233003
960 DATA 20222,20202,20202,20202,20222
970 DATA 222,202,222,002,222
980 DATA 222,202,222,202,222
990 DATA 222,002,002,002,002
1000 DATA 222,200,222,202,222
1010 DATA 222,200,222,002,222
1020 DATA 202,202,222,002,002
1030 DATA 222,002,222,002,222
1040 DATA 222,002,222,200,222
1050 DATA 020,220,020,020,222
1060 DATA 222,202,202,202,222
1070 DATA 600066606060666600,600060006060606000600,600066606060666600,600060006060
606000600,666066606060666606
1080 DATA 553055305530553055305,535053505350535053505,355035503550355035505,535053505
```

680-740	Final part of selection routine
750-760	Routine to set score to zero if new game
770-810	Routine to update score on display
820	Player/Missile graphic construction. NB: * = heart character. Do not type /or/. 16* = 16 hearts, etc. Inv = inverse
830-860	Routine to set up P/M strings
870-890	Load Display List Interupt code to Page 6
900-910	Clear P/M strings between games
920	Colour register data
930	DLI code data
940-1080	First part of text data

PCN ProgramCards

Color Code Card 4 of 5

8319CC4/5

```
505350535,553055305530553055 3
1090 DATA 11101110111011101111,10001000101010100,11101000101011001111,0010100010
10101100,11101110111010101111
1100 DATA 3330333033303330335,3030303030003000300,3330330033303330333,3000303030
00003000 3,3000303033303330333
1110 DATA 3330333003003330335,3000030030303030030,3330030033303300030,0030030030
30303003 0,3330030030303030030
1120 DATA 0050005,0550050,5555500,0550050,0050005
1130 DATA 0030003,0330030,3333300,0330030,0030003
1140 POKE 764,255:? :? "PRESS ANY KEY TO CONTINUE"
1150 IF PEEK(764)=255 THEN 1150
1160 ? "J":RETURN
1170 GRAPHICS 18:SOUND 1,222,8,10:FOR D=1 TO 50:POSITION 5,3:POKE 756,209:? £6;"
ColOR-CODe":NEXT D:POKE 756,224
1180 FOR W=1 TO 18:P=INT(90*RND(0)+5):SOUND 1,P,10,10:FOR D=1 TO 20:NEXT D:NEXT
W:SOUND 1,0,0,0
1190 POSITION 4,7:? £6;"DO YOU WANT":? £6:? £6;"  INSTRUCTIONS Y/N"
1200 IF PEEK(764)=35 THEN RETURN
1210 IF PEEK(764)<>43 THEN 1200:REM 10040
1220 GRAPHICS 0:POKE 764,255:POKE 752,1
1230 ? :? :? " The object of the game is to match   ATARIS choice of COLOR CODE
of 4 or 5 pegs ";
1240 ? "Each peg may be one of 6 colors.":? :? "In difficulty 3 and 5 ATARI may
also  choose to leave one or ";
1250 ? "more blank     spaces.":? :? "After every attempt you will be shown how
near you are by black and white"
1260 ? "pegs":? :? "BLACK pegs show that the color is      correct and in the  c
orrect position."
1270 ? "WHITE pegs show that the color is      correct but in wrong position.":G
OSUB 1140
1280 ? " There are 5 DIFFICULTY LEVELS"
1290 ? :? "1  Easy. The position of the BLACK andWHITE pegs corresponds to the p
ositionof your choice of colours"
1300 ? :? "2 The BLACK and WHITE pegs are placed in a random order and so do not
 relatedirectly to your choice"
1310 ? :? "3 Is the  same as No.2,but the ATARI  may choose to leave one or more
 pegs   blank"
1320 ? :? "4 ATARI chooses a 5 peg code. BLACK     and WHITE pegs as No 2"
1330 ? :? "5 Same as No 4 but may leave one or     more pegs blank":GOSUB 1140
1340 ? "To check your answers PRESS SPACE BAR":? :? "The scores are added togeth
er for each game until 5 games ";
1350 ? "have been played":? :? "5 arrows are shown in the top right   corner of
the screen. ";
1360 ? " One arrow is   removed for each game to indicate the number of games pl
ayed"
1370 ? :? "      PRESS START TO BEGIN"
1380 IF PEEK(53279)<>6 THEN 1380
1390 RETURN
```

1090-1130	Final part of text data
1140-1150	Routine used by instructions. NB: Inverse for "Press any key to continue"
1160	Clear screen and return
1170-1210	Title display plus music. NB: 1170 Inverse for "Col", "–", "De". Normal for "OR", "CO"
1220-1390	Routine to print instructions

NB: 1230 Inverse for "Color Code"
1260 Inverse for "Black"
1270 Inverse for "White"
1280 Inverse for "5 difficulty levels"
1290 Inverse for "1", "Black", "White"
1300 Inverse for "2", "Black", "White"
1310 Inverse for "3", "2"
1320 Inverse for "4", "Black", "White", "2"
1330 Inverse for "5", "6"
1340 Inverse for "SPACE"
1350 Inverse for "START"

PCN ProgramCards

Color Code Card 5 of 5

8319CC5/5

```
1400 GRAPHICS 18:POKE 708,238:POKE 712,26:POSITION 1,2:? £6;"SELECT  DIFFICULTY"
1410 POKE 764,255:POKE 53761,168:POKE 53768,1:POKE 53775,3:POKE 53760,100:POKE 5
3763,168
1420 ? £6:? £6;"  1":B$="beginner":FOR W=1 TO 8:FOR I=1 TO 16-W:POSITION 19-I,4:
? £6;B$(W,W);" ":NEXT I
1430 T=T-1:T=ABS(T):POKE 53768,T:POKE 53762,PEEK(53770):NEXT W
1440 ? £6;"  2":B$="normal":FOR W=1 TO 6:FOR I=1 TO 16-W:POSITION 19-I,5:? £6;B$
(W,W);" ":NEXT I
1450 POKE 53762,PEEK(53770):POKE 53760,20*W:NEXT W
1460 ? £6;"  3":B$="advanced":FOR W=1 TO 8:FOR I=1 TO 16-W:POSITION 19-I,6:? £6;
B$(W,W);" ":NEXT I
1470 POKE 53762,PEEK(53770):POKE 53760,100+W*W:NEXT W
1480 ? £6;"  4":B$="wizard":FOR W=1 TO 6:FOR I=1 TO 16-W:POSITION 19-I,7:? £6;B$
(W,W);" ":NEXT I
1490 POKE 53762,PEEK(53770):POKE 53760,250-W*35:NEXT W
1500 ? £6;"  5":B$="mensa":FOR W=1 TO 5:FOR I=1 TO 16-W:POSITION 19-I,8:? £6;B$(
W,W);" ":NEXT I
1510 POKE 53762,PEEK(53770):POKE 53760,250/W:NEXT W:POKE 53761,0:POKE 53763,0
1520 GET £1,DIF:IF DIF<49 OR DIF>53 THEN 1520
1530 DIF=DIF-48:Z=74:IF DIF>3 THEN Z=68
1540 RETURN
1550 POKE 53760,168:RETURN
1560 IF GM<6 THEN GRAPHICS 10
1570 B$="000":FOR I=1 TO 5:POSITION 60+(16-GM*4),4+I:? £6;B$:NEXT I
1580 POKE 1538,220:GM=GM+1:FOR I=1 TO 10:FOR W=10 TO 0 STEP -1:SOUND 0,10*I,10,W
:NEXT W:NEXT I:SOUND 0,0,0,0
1590 RESTORE 1120:FOR I=1 TO 5:READ B$:POSITION 53,182+I:? £6;B$:NEXT I:FOR W=1
TO 15:IF PEEK(53279)=6 THEN 1620
1600 NEXT W:FOR I=1 TO 5:READ B$:POSITION 53,182+I:? £6;B$:NEXT I:FOR W=1 TO 10:
IF PEEK(53279)=6 THEN 1620
1610 NEXT W:GOTO 1590
1620 POP :POKE 1538,8:IF GM<5 THEN 1640
1630 GM=0:SC=0:GOSUB 1400:GRAPHICS 10:GOSUB 860:GOTO 30
1640 FOR L=6 TO 166 STEP 16:COLOR 0:PLOT 8,L:DRAWTO 36,L:PLOT 8,L+1:DRAWTO 36,L+
1:PLOT 8,L+2
1650 DRAWTO 36,L+2:PLOT 8,L+3:DRAWTO 36,L+3:PLOT 8,L+4:DRAWTO 36,L+4
1660 PLOT 43,L-1:DRAWTO 57,L-1:PLOT 43,L:DRAWTO 57,L:PLOT 43,L+1:DRAWTO 57,L+1:P
LOT 43,L+2
1670 DRAWTO 57,L+2:PLOT 43,L+3:DRAWTO 57,L+3
1680 NEXT L:GOSUB 900:GOTO 30
```

1400-1559	Menu/level selection
1420	Inverse for "1", "Beginner"
1440	Inverse for "2", "Normal"
1460	Inverse for "3", "Advanced"
1480	Inverse for "4", "Wizard"
1500	Inverse for "5", "MENSA"
1560-1610	Routine to remove 1 game indicator arrow. Displays prompt and awaits "START" pressed
1620-1680	Routine to clear playing grid of all pegs

PCNProgramCards

Wreck Card 1 of 8

8319W1/8

Dragon 32
Dragon Basic

Application: Adventure
Author: Jane Kennedy

An entertaining adventure with full sound

```
10 CLEAR2000
20 CLS:GOSUB1750
30 DIMA$(31),B$(12),B(12),C$(41),C(41,3),D(4,31),D$(6)
40 GOSUB2490
50 GOSUB2010
60 CLS:PRINTD$(L):GOTO210
70 PRINT"I DON'T UNDERSTAND":GOTO210
80 PRINT"WHAT WITH?":GOTO210
90 PRINT"YOU CAN'T DO THAT":GOTO210
100 PRINT"YOU ARE NOT CLOSE ENOUGH":GOTO210
110 PRINT"YOU SEE NOTHING OF INTEREST":GOTO210
120 PRINT"IT LOOKS VERY INTERESTING":GOTO210
130 PRINT"EVEN THE CROWBAR WILL NOT FORCE THIS DOOR OF THE TREASURE STORE":FORX=
1TO2000:NEXTX:L=26
140 CLS:IFTIMER/50>1000 THEN2540
150 PRINTA$(L):FORX=1TO41:IFC(X,3)=L ANDL<>0  THENPRINT"YOU SEE A ";C$(X)
160 NEXTX:IFL<>0 THENOC=OC*2
170 IFOC>=32 ANDL<>0 THEN2550
180 IFC(1,3)=L AND L<>0 THEN190 ELSE210
190 OC=1:PRINT"LOOKOUT!..."
200 IFOC>0 THEN PLAY"T250V31L805CDEFGABCDEFGABCDEFGABCDEFGAB"
210 INPUT"WHAT NOW....";Q$
220 FOR X=1TOLEN(Q$):IFMID$(Q$,X,1)=" " THEN240
230 NEXTX:V$=Q$:GOTO300
240 V$=LEFT$(Q$,X-1):N$=RIGHT$(Q$,LEN(Q$)-X)
250 FORX=1TO12:IFV$=B$(X) THEN270
260 NEXTX:GOTO70
270 V=B(X):FORX=1TO41:IFN$=C$(X) THEN290
280 NEXTX:IF V=1 THEN110 ELSEGOTO70
290 N=C(X,1):ON V GOTO1010,950,1140,660,1460,390,900,1330,810,600,680
300 IFV$="LOOK" AND W=1  THEN140
310 IFV$="LOOK" AND W=0 THEN 60
320 IFV$="HELP" THEN380
330 IFV$="INV" THEN880
340 IFV$="DIVE" THEN810
350 IFV$="EQUIP" THEN850
360 IFV$="SCORE" THEN1370
370 GOTO70
```

10	Reserve adequate space for variables and arrays
20	Clear screen and perform initialisation routine
30	Assign arrays
40	Perform introduction routine
50	Perform routine to load appropriate data to look-up arrays
60	Start of adventure. Clear screen, display location, perform prompt and response routine
70-120	Negative response messages to action requested
130	Mmmmmm!
140	Clear screen and time check. Find out why
150-160	It depends where you are as to what you see
170	This spells trouble
180-190	Possibly a warning
200	Some music
210-370	Routine performed to prompt, input action and check allowed vocabulary

PCNProgramCards

Wreck Card 2 of 8

8319W2/8

```
380 PRINT"YOU WERE BORED-WORK IT OUT FOR  YOURSELF":GOTO210
390 IFN=7 ANDL=1 THENL=2 :GOTO60
400 IFN=7 THEN70
410 IFN=17 ANDL=2 ORN=17 AND L=6  THENL=3 :GOTO60
420 IFN=17 THEN70
430 IFN=12ANDL=3 THENL=5 :GOTO60
440 IFN=12 THEN70
450 IFN=25 ANDL=3 THENL=4 :GOTO60
460 IFN=25 THEN70
470 IFW=0 THEN90
480 IFN=24 AND L=1 ORN=24 AND  L=20 OR N=24 AND L=24 THEN 590
490 IFN=24 THEN 70
500 IFN=36 AND C(36,3)=13 THEN L=25:GOTO140
510 IFL=25 AND N<>18 THEN 90
520 IFN=20 AND D(1,L)=1 THEN L=L+1
530 IFN=21 AND D(2,L)=1 THEN L=L-1
540 IFN=22 AND D(3,L)=1 THEN L=L-3
550 IFN=23 AND D(4,L)=1 THEN L=L+3
560 IFN=18 AND D(3,L)=2 AND L<>2 THENL=L-12
570 IFN=19 AND D(3,L)=2 THENL=L+12
580 IFL=25 THEN 130 ELSE 140
590 L=0:T=TIMER:GOTO140
600 IF SA=1 AND N=26 THEN 630
610 PRINT"I'LL TELL YOU MY STORY IF YOU   BUY ME A DRINK":GOTO210
620 GOTO70
630 L=3:PRINTD$(6)
640 INPUT"PRESS <ENTER> TO CONTINUE";X$
650 GOTO60
660 IFN=27 AND L=4 THEN SA=1:PRINT"CHEERS!":GOTO210
670 GOTO70
680 IFL<>5 THEN70
690 PRINT"YES I HAVE A YACHT TO CHARTER","AND IT IS FULLY EQUIPPED BUT","REMEMBE
R YOU ONLY HAVE ENOUGH","OXYGEN FOR 15 MINUTES DIVING":L=0:W=1:PRINT
700 INPUT"PRESS ENTER TO EMBARK";Q$
710 CLS:PRINT"WHILE YOU SAIL TO THE AREA OF","SEA IN QUESTION YOU FAMILIARISE YO
URSELF WITH THE NAVIGATION","COMPUTER."
720 PRINT"A LIST OF ITEMS ON BOARD CAN BE OBTAINED BY TYPING 'EQUIP'"
730 PRINT"INPUT 'N' TO GO NORTH"
740 PRINT"INPUT 'S' TO GO SOUTH"
750 PRINT"INPUT 'E' TO GO EAST"
760 PRINT"INPUT 'W' TO GO WEST"
770 PRINT"INPUT 'R' FOR A SONAR REPORT"
780 PRINT"INPUT 'D' TO DROP ANCHOR"
790 INPUT"PRESS <ENTER> ON ARRIVAL IN THE AREA";Q$
800 GOTO1480
```

380	**No comment!!!**
390-590	Section to perform further analysis of action.
600-670	Hello sailor! Perhaps you get his story in exchange for a drink.
680	Very restricted by what you do here.
690-800	Pertinent information for the sea journey.

Wreck — Card 3 of 8

8319W3/8

```
810 IFL<>0 THEN70
820 IFC(14,2)<>1 THEN840
830 L=1:TIMER=T:GOTO2610
840 PRINT"HOW ARE YOU GOING TO BREATHE?":GOTO210
850 IFL=0 THEN PRINT"ON BOARD YOU HAVE:" ELSE70
860 FORX=1TO41:IFC(X,2)=2 THEN PRINTC$(X)
870 NEXTX:GOTO210
880 PRINT"YOU ARE CARRYING:":FORX=1TO41:IF C(X,2)=1 THENPRINTC$(X)
890 NEXTX:GOTO210
900 FORX=1TO41:IF C(X,1)=N AND C(X,2)=1 THEN920
910 NEXTX:PRINT"YOU DON'T HAVE IT":GOTO210
920 IF N=14 THEN 840
930 I=I-1:C(X,3)=L:IFL=0 THEN C(X,2)=2 :PRINT"O.K.":GOTO210
940 C(X,2)=0:GOTO210
950 IFN=3 THEN1000
960 FORX=1TO41:IFI>4 THEN990ELSE IF C(X,1)=N AND C(X,3)=L THEN980
970 NEXTX:GOTO90
980 C(X,2)=1:C(X,3)=0:I=I+1:PRINT"OK YOU'VE GOT IT":GOTO210
990 PRINT"YOU CAN'T CARRY ANY MORE":GOTO210
1000 PRINT"THE POISONOUS BARBS TEAR THROUGHYOUR SKIN":FORD=1TO1500:NEXTD:GOTO256
0
1010 IFL=1 AND N=29 THEN100ELSE IFL=3 AND N=30 THEN100
1020 IFL=2 AND N=32 THEN100
1030 IFL=13 AND N=34 THEN120
1040 IFL=13 AND N=35 AND TR=1 THEN120
1050 IFL=15 AND N=37 THEN110 ELSE IFL=17 AND N=36 THEN120
1060 IFL=18 AND N=38 AND CR=0 THEN 1110
1070 IFL=22 AND N=39 AND LO=0 THEN1120
1080 IFL=23 AND N=5 THEN120
1090 IFN=4 THEN1130
1100 GOTO110
1110 C(16,3)=L:CR=1:PRINT"THE ONLY ONE RECOGNISABLE IS A  CROWBAR":GOTO210
1120 C(31,3)=L:LO=1:PRINT"ENTANGLED IN THE SKELETON'S     FINGERBONES IS A GOLD
LOCKET":GOTO210
1130 PRINT"THE ONLY LEGIBLE WORDS ARE-      'OUR TRUST IS BENEATH US'":GOTO210
1140 IFC(16,2)=1 AND L=4 AND N=29 THEN1210 ELSE IF L=4 AND N=29 THEN80
1150 IFC(16,2)=1 AND L=6 AND N=30 THEN1240 ELSE IFL=6 AND N=30 THEN80
1160 IFC(6,2)=1 AND L=13 AND N=34 THEN1270 ELSE IF L=13 AND N=34 THEN80
1170 IFC(16,2)=1 AND L=13 AND TR=1 AND N=35 THEN1300 ELSE IFL=13 AND TR=1 AND N=
35 THEN80
1180 IFL=23 AND N=7 THEN130
1190 IFL=0 AND N=10 AND C(10,2)>0  THEN1310 ELSE IFN=10 THEN1320
1200 GOTO70
1210 IFSE<>0 THEN 1230 ELSEPRINT"YOU SEE A SEXTANT"
1220 C(9,3)=L:SE=1:GOTO210
1230 PRINT"IT'S EMPTY":GOTO210
```

810	Wrong again.
820-840	Dive selection—with oxygen timer!
850-870	Possible inventory on board yacht.
880-890	Possible inventory on your person.
900-910	Surely you can remember what you have with you?
920	Are you aquatic?
950	Trouble again.
960-990	Some things you can't do, and you can't carry too much.
1000	Dead!
1010-1100	You are looking. Routine to check if anything is there.
1110-1130	Aha! What have we found?
1140-1170	What are you trying to do?
1180	You've found a door.
1190	Could be good or bad.
1200	Try again.
1210-1230	Whatever you looked in could be empty.

PCNProgramCards

Wreck — Card 4 of 8

8319W4/8

```
1240 IFKE<>0 THEN1260 ELSEPRINT"YOU SEE A GOLDEN KEY AMONG THE  RUSTING IRON CHA
INS"
1250 C(6,3)=L:KE=1:GOTO210
1260 PRINT"YOU SEE NOTHING BUT RUSTING     CHAINS":GOTO210
1270 IF DI<>0 THEN1290 ELSEPRINT"YOU HAVE FOUND A BRASS BOUND DIARY"
1280 C(4,3)=L:DI=1:GOTO210
1290 PRINT"THE DESK IS EMPTY":GOTO210
1300 C(36,3)=L:PRINT"YOU SEE A HOLE":GOTO210
1310 PRINT"CONGRATULATIONS-GOLD AND JEWELS SPILL OUT, THEIR BEAUTY UNMARREDBY LO
NG IMMERSION":GOTO1370
1320 PRINT"IT IS UNWISE TO DO SO UNDER     WATER":GOTO210
1330 IFN=1 AND C(16,2)=1 OR C(13,2)=1 OR C(15,2)=1 OR C(8,2)=1 THEN 1350
1340 IFN=1 THEN80 ELSE70
1350 PRINT"CONGRATULATIONS YOU HAVE KILLED THE POOR CREATURE":OC=0:C(1,3)=0
1360 GOTO210
1370 IFC(4,2)<>0 THEN SC=SC+10
1380 IFC(9,2)<>0 THEN SC=SC+10
1390 IFC(10,2)<>0 THEN SC=SC+100
1400 IFC(11,2)<>0 THEN SC=SC+10
1410 IFC(31,2)<>0 THEN SC=SC+10
1420 IFC(6,2)<>0 THEN SC=SC+10
1430 PRINT"YOU HAVE SCORED ";SC;"OUT OF 150":SC=0
1440 INPUT"HAVE YOU FINISHED YOUR GAME",0$
1450 IF0$="Y" THEN END ELSE 210
1460 IFL=13 AND N=34 AND TR=0 THEN1470 ELSE210
1470 C(35,3)=L:TR=1:PRINT"YOU HAVE UNCOVERED A TRAPDOOR":GOTO210
1480 CLS3
1490 P1=0:P2=0:W1=INT(RND(31))*2:W2=INT(RND(14))*2
1500 SET(P1,P2,8)
1510 PRINT@480,"                              ";
1520 PRINT@480,"YOUR ORDERS, SIR";
1530 A$=INKEY$:IFA$="" THEN1530
1540 IFA$="A" THEN1630
1550 IFA$="D" THEN 1730
1560 SET(P1,P2,3)
1570 IFA$="N" THENP2=P2-2:IFP2<0 THENP2=0
1580 IFA$="S" THENP2=P2+2:IFP2>28 THENP2=28
1590 IFA$="E" THENP1=P1+2:IFP1>62 THENP1=62
1600 IFA$="W" THENP1=P1-2:IFP1<0 THENP1=0
1610 SOUND50,1
1620 GOTO1500
1630 SOUND235,5:FORD=1TO75:NEXTD:SOUND235,2
1640 IF(P1-W1)>10 OR (P2-W2)>10 OR (W1-P1)>10 OR (W2-P2)>10 THEN1710
1650 PRINT@480,"ECHO BEARING ";:IFP2>W2 THENPRINT"NORTH";
1660 IFP2<W2 THENPRINT"SOUTH";
1670 IFP1>W1 THENPRINT"WEST";
1680 IFP1<W1 THENPRINT"EAST";
1690 IFP1=W1 AND P2=W2 THENPRINT"BENEATH US",
1700 GOTO1720
```

1240-1260	Something good, or nothing much.
1270-1290	Check the desk(?)
1300	How useful.
1310	Yippee!
1320	Whatever it was, it's not a good idea.
1330	Vicious!
1350-1360	James Bond does it again.
1370-1450	A winner—update score—prompt and response for another game.
1460-1470	Well, well, well.
1480-1620	Navigation computer commands and actions.
1630-1700	Routine for sonar report on echo check.

Wreck — Card 5 of 8

8319W5/8

```
1710 PRINT@480,"NO ECHO     "
1720 FORD=1TO1000:NEXTD:GOTO1500
1730 IFP1=W1 ANDP2=W2 THENPRINT@480,"ANCHOR'S AWEIGH,SIR";:PLAY"O2T2L4CL8EGL6AL1
2EA":FORD=1TO1000:NEXTD:CLS:PRINT"YOUR YACHT IS NOW AT ANCHOR      ABOVE THE WREC
K":GOTO210
1740 GOTO1500
1750 CLS2
1760 FORX=0TO447:PRINT@X,CHR$(175);:NEXTX
1770 FORX=1TO4:A$=A$+CHR$(191):NEXTX
1780 FORX=1TO5:B$=B$+CHR$(191):NEXTX
1790 FORX=1TO5:C$=C$+CHR$(191):NEXTX
1800 D$=CHR$(191)
1810 FORX=1TO17:E$=E$+CHR$(191):NEXTX
1820 FORX=1TO15:F$=F$+CHR$(191):NEXTX
1830 PRINT@352,A$+D$+B$;:PRINT@369,C$;
1840 PRINT@388,D$+E$;
1850 PRINT@421,D$+F$;
1860 FORX=301TO365STEP32
1870 PRINT@X,D$;:NEXTX
1880 FORX=391TO403STEP2:PRINT@X,CHR$(189);:NEXTX:FORX=424TO434STEP2:PRINT@X,CHR$
(183);:NEXTX
1890 S=220
1900 FORX=28TO412STEP32:PRINT@X,CHR$(255);:SOUNDS,1:S=S-10:FORD=1TO150:NEXTD:PRI
NT@X,CHR$(175);:NEXTX
1910 PRINT@444,CHR$(255);:SOUND80,1
1920 W$=CHR$(207)
1930 S$=CHR$(175)
1940 PRINT@34,W$+S$+S$+S$+S$+S$+W$+S$+W$+W$+W$+W$+S$+W$+W$+W$+W$+S$+W$+W$+W$+W$+
S$+W$+S$+S$+W$;
1950 PRINT@34+32,W$+S$+S$+S$+S$+S$+W$+S$+W$+S$+S$+W$+S$+W$+S$+S$+S$+S$+W$+S$+S$+
S$+S$+W$+S$+W$;
1960 PRINT@99,W$+S$+W$+S$+W$+S$+S$+W$+W$+W$+W$+S$+W$+W$+W$+S$+S$+W$+S$+S$+S$+S$+
W$+W$;
1970 PRINT@131,W$+S$+W$+S$+W$+S$+S$+W$+S$+W$+S$+S$+W$+S$+S$+S$+S$+W$+S$+S$+S$+S$
+W$+S$+W$;
1980 PRINT@164,W$+S$+W$+S$+S$+S$+W$+S$+S$+W$+S$+W$+W$+W$+W$+S$+W$+W$+W$+W$+S$+W$
+S$+S$+W$;
1990 PLAY"T404L8CO3B04CO3L6CCL8GFEGL1004CO3B04C":PLAY"T201V1CC#V>CC#V>CC#V>CC#V>
CC#V31CC#CC#CC#CC#CC#"
2000 RETURN
```

1710-1720	Sonar report on no echo.
1730-1740	Routine to deal with anchoring at correct location.
1750-2000	Routine called on program start to initialise screen display and play an introductory theme.

PCNProgramCards

Wreck — Card 6 of 8

8319W6/8

```
2010 L=1:T=0:C(8,2)=2:C(11,2)=1:C(13,2)=2:C(14,2)=2:C(40,2)=2:C(1,3)=INT(RND(31)
):C(10,3)=25
2020 TIMER=0:I=1:C(3,3)=20:C(15,3)=17
2030 FORX=1TO12:READB$(X),B(X):NEXTX
2040 DATALOOK,1,TAKE,2,OPEN,3,MOVE,5,BUY,4,GO,6,DROP,7,KILL,8,DIVE,9,ASK,10,CHAR
TER,11,GET,2
2050 FORX=1TO41:C(X,1)=X:READC$(X):NEXTX
2060 DATAOCTOPUS,CRATES,CORAL,DIARY,CASK,KEY,DOOR,KNIFE,SEXTANT,CHEST,MONEY,HARB
OUR,SHOVEL,AQUALUNG,CANNONBALL,CROWBAR,TAXI,UP,DOWN,FORWARD,AFT,PORT,STARBOARD,S
URFACE,BARRACUDA,SAILOR,DRINK,WRECK,BOX,LOCKER,LOCKET,CROWSNEST,BUNK,DESK,TRAPDO
OR,HOLE
2070 DATATABLE,TOOLS,SKELETON,ROPE,YACHT
2080 FORX=1TO6:READD$(X):NEXTX
2090 DATATHE AIR-CONDITIONED FOYER OF THEHOTEL STILTON HAS A REVOLVING   DOOR LE
ADING OUTSIDE
2100 DATAA DOORMAN STEPS FORWARD AND     OPENS THE TAXI DOOR
2110 DATAINSIDE THE TAXI THE DRIVER ASKS    'WHERE TO'
2120 DATAIN THE 'BARRACUDA' THE BARMAN   INDICATES A TABLE WHERE A SAILORAPPROAC
HES YOU
2130 DATAON ARRIVAL AT THE HARBOUR YOU GOSTRAIGHT TO THE CHANDLERS TO    CHARTER
 A YACHT
2140 DATAIN THE YEAR 1587 THERE WAS A    TERRIBLE STORM BREWING.......ANDNO-ONE
HAS FOUND THE TREASURE TOTHIS DAY - BUT I CAN TELL YOU   WHERE TO SEARCH.......A
RMED WITHTHIS INFORMATION YOU LEAVE THE  BAR AND FLAG A TAXI
2150 FORX=0TO31:READA$(X),D(1,X),D(2,X),D(3,X),D(4,X):NEXTX
2160 DATAYOU ARE NOW ON BOARD YOUR YACHT,0,0,0,0
2170 DATAYOU ARE ON THE BRIDGE. THE WHEELHANGS DRUNKENLY ON IT'S STAND.  BARNACL
ES AND SEAWEED ARE EVERY-WHERE BUT ON THE STARBOARD SIDE YOU SEE A FIXED BOX.FRO
M HERE   YOU CAN ALSO GO UP TO THE       SURFACE OR FORWARD,1,0,0,1
2180 DATATHIS IS THE GUNDECK.CANNONS AND CANNONBALLS ARE SCATTERED ABOUT.THE MAI
N MAST HAS FALLEN ON THE STARBOARD SIDE BUT THE CROWSNESTHAS REMAINED INTACT.FRO
M HERE   YOU CAN SWIM FORWARD STARBOARD  AFT AND YOU CAN SEE A STAIRWAY  GOING D
OWN,1,1,2,1
2190 DATAYOU ARE NOW ON THE FORWARD DECK.THE ANCHOR CHAINS ARE BADLY     CORRODE
D.ON THE STARBOARD SIDE  IS A CHAIN LOCKER.FROM HERE      THERE IS NO WAY DOWN,0
,1,0,1
2200 DATASMALL FISH DART OUT OF THE WAY  AS YOU APPROACH A LARGE BOX.    AFTER C
LEARING THE TOP OF       ENCRUSTATIONS YOU SEE IT IS     MARKED 'CHARTS',0,0,1,0
2210 DATAYOU ARE AT THE CROWSNEST,0,0,1,0
2220 DATAIN FRONT OF YOU IS THE CHAIN     LOCKER,0,0,1,0
2230 DATA,0,0,0,0
2240 DATA,0,0,0,0
2250 DATA,0,0,0,0
2260 DATATHIS IS THE CAPTAIN'S SLEEPING  QUARTERS.THE BEDDING HAS LONG   SINCE R
OTTED,0,0,0,1
```

2010	Start of DATA statement. Load routines called at program start. Initialise variables.
2020	Initialise more variables.
2030	Load commands and index numbers to B$(*),B(*).
2040	Data statements for 2030.
2050	Load artifacts and index numbers to C$(*),C(*,1).
2060-2070	Data statements for 2050.
2080	Load narrative to D$(*).
2090-2140	Data statements for 2080.
2150	Load locations and available direction indicators to A$(*),D(1,*),D(2,*),D(3,*),D(4,*).
2160-2260	First part of data statements for 2150.

Clubnet keeps you in touch with enthusiasts throughout the country. It is divided into two sections — microcomputing and user groups.

We publish a list of these groups on alternate weeks. This week user groups are listed alphabetically by machine and special interest.

Each week we focus on an individual club or group with a fly-on-the-wall report. This week we feature the West Herts 80 Users Association.

If your association has something special on the agenda or if you've just started a new one, contact us at *Clubnet, Personal Computer News*, VNU, 62 Oxford Street, London W1A 2HS.

The user groups listing is based on that of the Association of Computer Clubs.

Sweet as Tandy

The West Herts 80 User Association — specialising in Tandy and TRS80 machines — has taken some concerted action to keep its membership up. It has lost 20 members to the BBC and Spectrum colour machines over the past year and in a counter attack is producing its own high-resolution colour-boards.

The club nevertheless keeps a busy calendar. It runs courses in machine code programming and Basic and to keep the cost down for its own members, it offers these courses to members of other clubs.

Meeting fortnightly means that the club covers a lot of topics. And future projects include starting up a hardware/interface evening which will run on alternate weeks to club night.

Reg Smith, secretary of the club, said: 'The purpose of these evenings is to teach people how to use their equipment to operate and control external equipment. This will include construction and programming.'

The second project in the pipeline is to start a BBC computer section. He continued: 'We hope to run this group in the back rooms during our present club evenings. And if it takes off we will help the group to get organised.'

Mr Smith says his micro has brought his son Jason and himself closer together since they have been attending the club. Jason, 15, has written and sold several of his programs.

Among the 30 members that packed into the St Stephen Parish Centre in Brickett Wood, were two brothers who busily tapped away on their Video Genie and Tandy TRS-80 micros respectively — as club chairman Terry Bradbury gave an entertaining talk on HullForth.

'We usually have a talk of some sort that lasts for about an hour,' said Mr Smith.

Sandra Grandison

Name West Herts 80 Users Association **Venue** St Stephen Parish Centre, Brickett Wood, St Albans, Herts **Meetings** Fortnightly on Tuesdays **Contact** Reg Smith, 0442 60085

Reg Smith and his son watch a program running.

Club members listen to Terry Bradbury, chair of the club, deliver his talk on HullForth.

USER GROUPS

Acorn

Coventry Acorn Atom User Group. Peter Frost, 18 Frankwell Drive, Coventry, 0203 613156.
Kent Medway Acorn User Group. Meets at St John Fisher School on last Monday of month at 7pm. Sessions at 9pm Thursday at the Fox and Hound, Chatham. Clem Rutler, c/o St John's Fisher School, Ordance Street, Chatham, Kent, 0634 42811 (day), 0634 373459 (evenings).
Manchester Acorn User Group. Meets at AMC, Crescent Road, Crupsall, Manchester 8 on Tuesday except school holidays. John Ashurst, 192 Vendure Close, Failsworth, Manchester, 061-681 4962.

Apple

Bristol Apple Users and Dabblers. Meets at 10 Waring House, Redcliffe Hill, Bristol BS1 6TB, once a month. Ewa Dabkowski, c/o Datalink, 10 Waring House, Redcliffe Hill, Bristol BS1 6TB, 0272 213427.
Buckinghamshire Apple User Group. Steve Profitt, The Granary, Hill Farm Road, Marlow Bottom, Buckinghamshire, 062 84 73074.
Croydon Apple User Group. Meets at Sidda House, 350 Lower Addiscombe Road, Croydon, on second Monday of month. Paul Vernon, 60 Flawkhurst Way, West Wickham, Kent, 01-777 5478.
London Apple Music Synthesis Group. Dr Davis Ellis, 22 Lennox Gardens, London SW1.
Milton Keynes Microcomputer User Group. Meets every Tuesday, 7.30pm. Brian Pain, Sir Frank Markham School, Woughton Centre, Chaffron Way, Milton Keynes.

Atari

Birmingham User Group. Meets at the Malaga Grill, Matador Public House, Bull Ring shopping centre, Birmingham, on second and fourth Thursday every month at 7.30pm. Mike Aston, 42 Short Street, Wednesbury, West Midlands.
Carshalton Atari User Club. Paul Deegan, 01-642 5232.
Hull Atari Users Local Group. Harvey Kong Til, 546 Holderness Road, Hull HU9 3ES. Hull 7911094.
London Silica Atari 400/800 User Club. Richard Hawes, 01-301 1111.
Norwich Atari User Group. Ken Ward, Norwich 661149.
Preston Atari Computer Enthusiasts. Meets at KSC Club, Merrion House, Beach Grove, Ashton, Preston, on third Thursday of month at 7.30pm. Roger Taylor, 0253 738192.

Atom

Liverpool BBC and Atom User Group. Meets at Old Swan Technical College, Room C33 on first Wednesday of month at 7.30pm and at Birkenhead Technical College on third Thursday of month at 7.30pm. Nick Kelly, 051-525 2934 (evenings).

BBC

Laserbug is an international user group for the BBC micro. Paul Barbour, 10 Dawley Ride, Colnbrook, Slough, Berks, 02812 30614.
Beebug. Sheridan Williams or David Graham at PO Box 50, St Albans, Hertfordshire AL1 2AR.
Bournemouth BBC User Group. Meets at Lansdowne Computer Centre, 5 Holdenhurst Road, Bournemouth on first and fourth Wednesday of month at 7.30pm. Norman Carey, 0202 749612.
Brent/Barnet User Group. Meets on last Sunday of month. Joseph Fox, 4 Harman Close, London NW2 2EA.
North London BBC Micro Users Group. Meets at The Prince of Wales, 37 Fortune Green Road, on Tuesdays at 7pm. Dr Leo McLaughlin, Westfield College, University of London, Kidderpore Avenue, London NW3 7ST, 01-435 0109.
Preston area BBC Micro User Group. Meets at Boatmans Arms, Marsh Lane, Preston, on last Thursday of month. Duncan Coulter, 8 Briar Grove, Ingol, Preston, Lancashire, 0772 725793.
Witham (NAMEBUG) BBC Micro User Group. Meets at comprehensive school, Witham on second Thursday each month at 7.30pm. Dave Watts 0245 358127 after 7pm.

Comal

London Comal User Group. Meets at Polytechnic of North London, Holloway, second Wednesday of month, term time. John Collins, 75 74111.

Commodore ICPUG

Barnsley. Bob Wool, 13 Ward Green, Barnsley, South Yorkshire, 0226 85084.
Blackpool. Meets at Arnold School, Blackpool, on third Thursday of month. David Jarrett, 197 Victoria Road, Thornton Cleveleys, Blackpool FY5 3ST.
Canterbury SE. Meets at The Physics Lab, Canterbury University, on first Tuesday and Wednesday of month. R Moseley, Rosemount, Romney Hill, Maidstone, 0622 37643.
Carrickfergus. David Bolton, 19 Carrickburn Road, Carrickfergus, Antrim BT38 7ND, 09603 63788.
Cheltenham. Meets at the Cheltenham Ladies College on last Thursday of month at

7.30pm. Alison Schofield, 78 Hesters Way Road, Cheltenham, Gloucester, 0242 580789.
Clwyd. John Poole, 6 Ridgway Close, Connah's Quay, Clwyd CH5 4LZ.
Corby. Peter Ashby, 215 Wincohn Way, Corby, Northamptonshire, 05363 4442.
Coventry. Meets at Stoke Park School and County College at 7pm on fourth Wednesday of month except July, August, December. Will Light, 22 Ivybridge Road, Stvyechale, Coventry, Warwickshire.
Derby. Meets at Derby Professional Colour every other Tuesday at 7pm. Robert Watts, 03322 72569.
Durham. North-East Pet and ICPUG. Meets at Lawson School, Burnley at 7pm second and third Mondays. Jim Cocallis, 20 Worcester Road, Newton Hall Estate, Durham.
Dyfed. Simon Kniveton, 097 086 303.
Hainault. Meets at Grange Remedial Centre, Woodman Path, Hainault. Carol Taylor, 101 Courtlands Avenue, Cranbrook, Ilford, Essex.
Glasgow. Dr Jim MacBrayne, 27 Daidmyre Crescent, Newton Mearns. Glasgow, 041-639 5696.
Gloucester and Bristol Area. Meets at 23 Sheppard Leaze, Wotton-under-Edge, Gloucester, on last Friday of month.
Hampshire. Meets at 70 Reading Road, Farnborough, on third Wednesday of month. Ron Geere, 109 York Road, Farnborough, Hants, 0252 542921.
Hertfordshire North. Meets at Provident Mutual Assurance, Purwell Lane, Hitchin, on last Wednesday of month. B Grainger, 73 Minehead Way, Stevenage, Herts SG1 2HS, 0438 727925.
Kilmarnock. Meets at Symington Primary School on first and third Thursday of month at 7pm. John Smith, 19 Brewlands Road, Symington, Kilmarnock KA1 5RW, 0563 830407.
Liverpool. Meets at The Merchant Taylor School for Boys, Crosby, on second Thursday of month at 7pm. Tony Bond, 27 Ince Road, Liverpool L23 4UE, 051-924 1505.
London. Alan Birks, 135 Queen Alexandra Mansions, Judd Street, London WC1, 01-430 8025.
London North. Barry Miles, Department of Business Studies, North London Polytechnic, Holloway Road, London N7, 01-607 2789.
Norfolk. Peter Petts, Bramley Hale, Wretton, King's Lynn, Norfolk PE33 9QS, 0366 500692.
Northumberland. Graham Saunders, 22 Front Street, Guide Post, Northumberland.
Slough. Meets at Slough College on second Thursday of month at 7.30pm. Brian Jones, 53 Beechwood Avenue, Woodley, Reading RG5 3DF, 0734 661494.
South-East. Regional Group. Meets at Charles Darwin School, Jail Lane, Biggin Hill, Kent, on third and fourth Thursday of month at 7.30pm. Jack Cohen, 30 Brancaster Road, Newbury Park, Ilford, Essex, 01-597 1229.
South Midlands. Meets at 12 York Street, Stourport-on-Severn on last Thursday of month. M J Merriman at above address.
Staffordshire. 57 Clough Hall Road, Kidsgrove, Stoke-on-Trent.
Teddington. G Squibb, 108 Teddington Park Road, Teddington, Middlesex, 01-977 2346.
Watford. Meets on second Monday of month. Stephen Rabagtiati, c/o Institute of Grocery Dist. Grange Lane, Letchmore Heath, Watford, Herts. 01-779 7141.

Commodore Pet

Blackpool. West Lancashire Pet Users Club. Meets at Arnold School, Blackpool on the third Thursday of month. D Jowett, 197 Victoria Road, East Thornton, Blackpool FY5 35T.
Southern Users of Pets Association. Howard Pilgrim, 42 Compton Road, Brighton BN1 5AN.
Pet User Group Crawley. Richard Dyer, 33 Parham Road, Ilfield, Crawley.
Pet Users Education Group. Dr Chris Smith, Department of Physiology, Queen Elizabeth College, Camden Hill Road, London W8 7AH.
UK Pet Users Club. 360 Euston Road, London NW1 3BL.
Pet Users Group. Meets at Polytechnic of North London, Eden Grove, Room 320. On alternate Tuesdays, 6pm. Barry Miles 01-607 2789.
Pet User Club. Margaret Gulliford, 818 Leigh Road, Slough Industrial Estate, 0753 74111.
Independent Pet Users Group. 57 Clough Hall Road, Kielsgrove, Stoke-on-Trent, Staffordshire.

Commodore Vic

Burnley. John Ingham, 72 Ardwick Street, Burnley, Lancashire.
London. Vic Users Group. Meets on alternate Tuesdays at 6.30pm at Polytechnic of North London, Community Centre. Robin Bradbeer.
Norfolk. J Blair, 7 Beach Road, Cromer, Norfolk, 0263 512849.

Compucolour

Caversham. Compucolour Users Group UK. Meets at Community Centre, Caversham Park Village twice a year. Peter Hiner, 11 Pennycroft, Harpenden, Hertfordshire, 05827 64872.

CP/M

Irish CP/M Users Group. Meets monthly in Dublin area. Doug Notley, Gardner House, Ballsbridge, Dublin 4, Dublin 686411.
UK CP/M Users Group. Lesley Spicer, 11 Sun Street, London EC2M 2QD, 01-247 0691.

COSMAC

COSMAC Users Group. James Cunningham, 7 Harrowden Court, Harrowden Road, Luton, Bedfordshire, 0582 423934.

Digital Equipment

Digital Equipment Users Society. The Secretary, PO Box 53, Reading, Berkshire, 0734 387725.

Dragon

Brixham Dragon Owners Club. Meets at Computer Systems (Torbay), Pump Street, Brixham, every Saturday at 2.30pm. Ian Chipperfield, 22 Brookdale Court, Brixham, Devon, Brixham 59224.

Education

Birmingham. Education ZX80/81 User Group. Eric Deeson, Highgate School, Balsall Heath Road, Highgate, Birmingham B12 9DS.
Birmingham. MUSE. National body for co-ordinating activity in schools, colleges. Lorraine Boyce, MUSE Information Office, Westhill College, Weoley Park Road, Birmingham, 021- 471 3723.
Dublin. Computer Education Society of Ireland. Dairmuid McCarthy, 7 St Kevins Park, Kilmacud, Blackrock, Co. Dublin.
Middlesex. Educational Users Group. Offshoot of National TRS-80 Users Group. Dave Fletcher, Head Teacher, Beaconsfield First and Middle School, Beaconsfield Road, Southall, Middlesex.
Worcestershire. Mini and Microcomputer Users in Education. National organisation. R Trigger, 48 Chadcote Way, Catshill, Bromsgrove, Worcestershire B61 0JT.

Forth

Forth Users Group. David Husband, 2 Gorleston Road, Branksome, Poole, Dorset BH12 1NW, 0202 764724.
Forth Interest Group UK. Meets at Room 408, South Bank Polytechnic on the first Thursday of month. K Goldie-Morrison, 15 St Albans Mansion, Kensington Court Place, London W8 5QH, 01-937 3231.

Forum
Forum 80 Users Group. Frederick Brown, 421 Endike Lane, Hull HU6 8AG.

FX-500P
FX-500-P Users Association. Max Francis, 38 Grymsdyke, Great Missenden, Buckinghamshire HP16 0LP.

Genealogists
Society of Genealogists Computer Interest Group. Anthony Camp, 01-373 7054.

Intel MDS
UK Intel MDS Users Group. Lewis Hard, c/o S.P.A.C.E., The Old Coach House, Court Row, Upton-on-Severn, Worcester WR8 0NS.

Ithaca Audio S100
Ithaca Audio S100 Users Group. Dave Weaver, 41 Dore Avenue, North Hykenham, Lincoln LN6 8LN.

Jupiter Ace
Jupiter Ace Users Group. John Noyce, Remsoft, 18 George Street, Brighton BN2 1RH.

Mattel
Mattel Intellivision TV Game Group. Warrington 62215 after 4pm.

Medical
Durham. Primary Health Care Group. Dr Alastair Malcolm, British Computer Society, Cheveley Park Medical Centre, Belmont, Durham, 0385 64282.
London. Medical Micro Users Group. Medicom, 1-2 Hanover Street, London W1.
Middlesex. TRS-80 Medical and Laboratory Users. Dr Robinson, The Residency, Northwick Park Hospital, Harrow, Middlesex.

Nascom
Berkshire. Nascom Thames Valley User Group. Meets at Frogmore Hotel, Windsor, on Thursday fortnightly, 8pm. Mike Rothery, 37 Eaton Wick Road, Eton Wick, Windsor, Berkshire, Windsor 56106.
Birmingham Nascom User Group. Meets at Davenports Social Club, Granville Street, Birmingham on the last Thursday of month, 8pm. Martin Sidebotham, 021-744 3093.
International Nascom Microcomputer Club. 80 Oakfield Corner, Sycamore Road, Amersham, Buckinghamshire HP6 5EQ.
Merseyside Nascom User Group. Meets at Mona Hotel, St James Street, Liverpool, on the first Wednesday of month, 7.30pm. Mr T Searle, 051-526 5256.

Newbrain
Wakefield Independent Newbrain User Group. Anthony Hodge, 15 St John's Court, Wakefield WF1 2RY.

Ohio
Ohio Scientific User Group. Tom Graves, 19a West End, Street, Somerset, 0458 45359.

Oric
Oric Owners Group. Paul Kaufman, 3 Club Mews, Ely, Cambridgeshire.

Osborne
British Osborne Owners Group. J Anglesea, Flat 19, Rowan House, Mitton Road, Handsworth, Birmingham B20 2JR.

OSI
OSI UK User Group. Richard Elen, 12 Bennerley Road, London SW11 6DS.

Pascal
Pascal User Group. Nick Hughes, PO Box 52, Pinner, Middlesex HA5 3FE.

PDP
Buckinghamshire. PDP8 User Group. Nigel Dunn, 21 Campion Road, Widmer End, High Wycombe, Buckinghamshire, 0494 714483.
Hertfordshire. PDP11 User Group. Pete Harris, 119 Carpenter Way, Potters Bar, Hertfordshire EN6 5QB, 0707 52091.

Pilot
UK Pilot User Group. Alec Wood, Wirral Grammar School for Boys, Cross Lane, Bebington, Wirral, Merseyside LG3 3AQ.

Prestel
ACC National Prestel Committee. Administrates Club Spot 800 (hobbyists on Prestel). Rupert Steele, St John's College, Oxford OX1 3JP.

Research Machines
Birmingham. Research Machines 380Z. Peter Smith, Birmingham Educational Computing Centre, Camp Hill Teachers Centre, Statford Road, Birmingham.
Leamington Spa. West Midland RML User Group. Spencer Instone, c/o 59 Avenue Road, Leamington Spa.
Newcastle. NERML 380Z User Group. Meets monthly at Micro-Electronics Education Centre of the Polytechnic Coach Lane Campus. Mr Hatfield or Mr Reed, Computer Unit, Northumberland Building, Newcastle Polytechnic, 0632 326002.
Oxford. Research Machines National User Group. RML, Mill Street, Osney, Oxford OX2 0BW, 0865 249866.
Oxford. Research Machines Ltd National User Group. M D Fisher, PO Box 75, Oxford OX4 1EY.

Sharp MZ80
Aberdeen. International Sharp Users Group. Graham Knight, c/o Knights Computers, 108 Rossemount Place, Aberdeen, 0224 630526.
Essex. Sharp MZ80K User Group. Joe Street, 16 Elmhurst Drive, Hornchurch, Essex RM11 1PE.
Leeds. Sharp PC1211 Users Club. Jonathan Dakeyne, 281 Lidgett Lane, Leeds LS17 3AQ.
Somerset. Sharp MZ80 Users Club. Tim Powell, Computer Centre, Yeovil College, Yeovil, Somerset BA21 4AE.

Sinclair
Brighton. ZX Users Group. J Ireland-Hill Jnr, 145 Godwin Road, Hove, Brighton.
Aylesbury. Sinclair ZX Computer Club. Ken Knight, 0296 5181.
Colchester Sinclair User Group. Meets fortnightly. Richard Lawn, 102 Prettygate Road, Colchester, Essex.
Cardiff. ZX Club. Meets on last Sunday of month, 2pm. Mike Hayes, 54 Oakley Place, Grangetown, Cardiff, 0222 371732.
Edinburgh. ZX. Meets at Claremont Hotel, Claremont Crescent, Edinburgh, on second and fourth Wednesdays every month, 7.30pm. John Palmer, 56 Meadowfield Drive, Edinburgh, 031-661 3183.
Glasgow. ZX80/81 User Group. Ian Watt, 10 Greenwood Road, Clarkston, Glasgow, 041-638 1241.
Liverpool. ZX Computer Club. Meets at ZX Computer Centre, 17 Sweeting Street, Liverpool, on Wednesday, 6.30pm. Keith Archer, 051-260 4950.
London. National ZX User Club. Tim Hartnell, Interface, 44-48 Earls Court, London W8.
London. Sinclair User Group. Meets at Polytechnic of North London, Room 2-5 Tower Block. Monday, 6.30pm. Irving Brand, Polytechnic of North London, Holloway Road, London.
ZX Spectrum Club. D Beattie, 63 Kingsley Crescent, Sawley, Long Eaton, Nottingham NG10 3DA.
Staffordshire. ZX80 National Software Association. 15 Woodlands Road, Wombourne, Staffordshire WV5 0JZ.
Suffolk. ZX Amateur Radio User Group. Paul Newsman, 3 Red House Lane, Leiston, Suffolk, SAE essential. No telephone inquiries.
Surrey. Guildford ZX80/81 Users Group. Meets Fridays. A Bond, 54 Farnham Road, Guildford, Surrey GU2 5PE, 0483 62035.
Surrey. ZX80/81 User Club. David Bigden, PO Box 159, Kingston-upon-Thames, Surrey KT2 5UQ.
West Sussex. Hassocks ZX Micro User Club. Paul King, 25 Fir Tree Way, Hassocks, West Sussex.

Sirius
Sirius User Group. Ray D'Arcy, Sirius User Club, The Microsystems Centre, Enterprise House, 7-71 Gordon Street, Luton, 0582 412215.

68XX
68XX Special Interest Group. Tim Turner, 63 Millais Road, London E11 4HB, 01-558 3681.

Software
London. Software Group. Meets at Polytechnic of North London, Room 2-3 Tower block Thursday, 6pm. Mike Duck at Polytechnic of North London, Holloway, London N7.
Oxford. Program of the Month Club. Mr Durrant, 55 St Thomas Street, Oxford OX1 1JG, 0855 250333.

Sorcerer
Liverpool European Sorcerer Club. Monthly meetings. Colin Marle, 32 Watchyard Avenue, Formby, near Liverpool L37 3JU, 07048 72137.
Surrey. Exidy Sorcerer User Group. Andy Marshall, 44 Arthurs Bridge Road, Woking, Surrey GU21 4NT.

Spreadsheet
International Electronic Spreadsheet Users Group. UK Alpha House, 7th Floor, Rowlandsway, Manchester M22 5RG.

Tangerine
Avon. Tangerine Users Group. Bob Green, 1 Marlborough Drive, Worle, Avon, 0934 21315.
Bristol. Tangerine Homebrew. A Coales, 35 Mogg Street, St Werburghs, Bristol BS2 9UB.

Texas Instruments
Leeds. TI99/4 A User Group. Meets at 30 Gipton Wood Road, Leeds 8, Mondays 7pm. I Youlden, 0532 401408.
Manchester. TI User Group. T Grimshaw, 21 Allingham Street, Longsight, Manchester.
Manchester. TI9900 User Group. Chris Cadogan, Department of Computer Science, University of Manchester M13 9PL.

Triton
Triton User Group. Nigel Stride, Transam Ltd, 12 Chapel Street, London NW1, 01-402 8137.

TRS-80
Birmingham. National TRS-80 User Group. Meets at Adam & Eve Pub, 1st Floor, Bradford Street, Birmingham on last Friday of month. Michael Gibbons, 1 New Street, Castle Bromwich, Birmingham B38 9AP, 021-747 2260.
Chelmsford. TRS-80 User Group. Michael Dean, 22 Roughtons, Galleywood, Chelmsford, Essex.
Durham. North East TRS-80 User Group. Meets at Information Technology Centre, Gateshead on the third Wednesday of month, 7pm. J Dunn, 8 Ettrich Terrace, North Gateshead, County Durham.
Edinburgh. Scottish TRS-80 and Genie User Group. Meets at Mansion House Hotel, Milton Road, second Thursdays of month. Dick Mackie, 3 Warrender Park Crescent, Edinburgh EH9 1DX, 031-229 6032.
Isle of Wight. TRS-80 User Club. Meets at London Hotel, Ryde on last Friday of month. 7.30pm. Sean Coulson, 0903 614589.
Kent. TRS-80 User Group. Alan Reid, 22 Woodeys Road, Rainham, Kent, 0634 367012.
Bolton. Northwest TRS-80 User Group. Meets at Barton Aero Club, Barton Aerodrome, Irlam, near Manchester on last Wednesday of month, 8pm. Sub group meets at Crown Hotel, Blackfriars Street, on first and third Monday of month. Melvin Franklin, 40 Cowlees, Westhoughton, Bolton, Lancashire.
Liverpool. UK DOSPLUS User Group. Peter Toothill, 101 Swanside Road, Liverpool L14 7NL. 051-220 9733.
Liverpool. Merseyside TRS -80/Video Genie User Group. Meets second Thursday of month. 7.15pm. Peter Toothill, 101 Swanside Road, Liverpool L14 7NL. 051-220 9733.
London, SW. TRS-80 User Group. Ron Everitt on 01-394 2123.
Merseyside. TRS-80 User Group. N Rushton, 123 Roughwood Drive, Northwood, Kirby, Merseyside.
Milton Keynes. National TRS-80 and Genie User Group. Brian Pain, 24 Oxford Street, Stony Stratford, Milton Keynes.
London. TRS-80 Genie Group. Meets at Central Common Room, The Residency, Northwick Park Hospital on first Sunday of month. Dr Nick Robinson, Central Room, The Residency, Northwick Park Hospital.
Northants. TRS-80 User Group. Meets at Welwyn Park Community Centre on alternate Thursdays at 7pm. Neil Griffiths, 0858 65718.
Nottingham. East Midlands TRS-80 User Group. Mike Costello, 15 Langbank Avenue, Rise Park, Nottingham NG5 5BU, 0602 751753.

Colour Genie
National Colour Genie User Group. Marc Leduc, 46 Highbury Avenue, Nottinghamshire NG6 9DB.

UCSD
Hants. UCSD System Users Society. John Ash, Dicoll Data Systems Ltd, Bond Close, Kingsland Estate, Basingstoke, Hants RG2 0QB.
Oxford. UCSD Pascal UK Users Group. Malcolm Harper, Oxford University Computing Laboratory Programming Research Group, 45 Banbury Road, Oxford OX2 6PE.

CUA
CUA User Group. Adrian Waters, 9 Moss Lane, Romford, Essex.

6502
Bedfordshire. 6502 User Group. Walter Wallenborn, 21 Argyll Avenue, Luton, Bedfordshire LU3 1EG, 0582 26927
Hants. 6502 User Group (Southern Region). Steve Cole, 70 Sydney Road, Gosport, Hants.

Remember

Let us know about your micro club or user group so we can be sure the information printed here is up to date. Drop a card to Wendie Pearson, Listings Editor, at *Personal Computer News*, 62 Oxford Street, London W1A 2HG, or give her a call on 01-636 6890.

DATABASICS

This week PCN Databasics lists a selection of add-ons for your micro. PCN keeps you up to date in three-week cycles, listing peripherals, then software, followed by micros.

Printers are best categorised by print-head type. The two most common methods of transferring type to paper are the **Dot matrix** and **Daisywheel** techniques.

A dot matrix printer uses a row of pins which are programmed to strike the paper through a ribbon and form the character as a pattern of dots.

The daisywheel acts more like a conventional typewriter, the character set being pre-formed on a wheel with each character on a separate spoke. As the interchangeable wheel rotates it is struck by a hammer to form the character impression.

Dot matrix printers tend to be faster than daisywheel but offer lower print quality.

In selecting a printer make sure the **interface** on your computer is compatible with those available as standard or at extra cost on the printer.

The ● sign means the interface is included in the price; O means you have a choice of interfaces included in the price; + means the interface will cost extra.

Max Baud rate indicates the approximate characters-per-second rate as they are fed into the printer.

The **buffer** stores characters sent by the computer. The printer can take characters in chunks, at a rate quicker than they are able to be printed, sometimes allowing the computer to be freed for further use.

Lines per inch indicates the maximum number of lines printed in a vertical inch. **Characters per inch** can be varied on some printers as the typesizes themselves can be adjusted.

Maximum print speed as indicated by the manufacturer tends to be a little optimistic. **Maximum print positions** tells you the optimum number of characters that can be printed in one line by the smallest character size on the printer. **Maximum paper width** is the widest paper the printer can take.

Size represents the space the printer takes up on a desk top. **The weight** of the printer is given in kilogrammes.

Maximum copies indicates the number of carbon copies that can realistically be produced at one time.

Underlining puts a line under characters while **bold type** thickens the characters to make them stand out. **True descenders** indicates that the print method allows for fully formed tails on letters such as p,g or q.

Proportional spacing puts the same space between characters whether they are a long 'm' or a short 'i'. **Block graphics** builds up pictures using rectangular blocks, while **High Resolution Graphics** uses smaller dots.

Bidirectional means the printer can save time by printing left to right and then doing the next line backwards right to left. Similarly, **Logic Seeking** enables the machine to save more time by printing the short lines without sweeping over the whole width of the page.

Feed methods comprise **fanfold** which uses continuous stationery sheets folded road-map style drawn into the printer by a tractor mechanism. The tractor cog fits into holes in the fanfold paper and takes the paper past the printer mechanism. **Roll** is a roll of paper that feeds into the printer, usually using **friction feed** where the paper is gripped between two rollers, typewriter-style. **Cut sheet** indicates the printer uses single sheets like a typewriter.

Distributor: to find which company distributes a particular add-on, use the code listed in this column to refer to the distributor table.

The table is at the end of the listings, and gives the distributor's name and telephone number.

PERIPHERALS

PRINTERS

Make & Model	Price inc VAT	Printhead type (M = matrix)	INTERFACES ● inc in price, ○ = options at extra cost (+)						Max baud rate	Buffer Memory Size (in characters)	Lines per inch	Characters per inch	Max print Speed (CPS)	Max print positions	Max paper width in inches	Size (base area in cms)	Weight (in kilos)	Max Copies	Underlining	Bold Type	True Descenders	Proportional Spacing	Block Graphics	High Resolution Graphics	Bi Directional	Logic Seeking	Feed Method					Distributor
			I-EEE	Centronics	20ma	RS232	Others ●	Others (+)																			Fan Fold	Roll	Cut Sheet	Tractor	Frictional	
Adler TRD 170	£833	Daisywheel		●		●			9600	256	6,8	10,12,15	17	198	15.5	56×37	13	6	●	●	●	●			●	●	●	●	●	●	●	T2
Anadex DP 9000A	£1,397	M 7×9, 9×9		●	●	●			9600	2700	6,8	10,12.5,15,16.7	200	106	9.5	40.9×57	13.6	6	●	●	●			●	●	●	●	●	●	●		I1
Anadex DP 9001A	£1,397	M 7×9, 11×9		●	●	●			9600	2700	6,8	10,12.5,15,16.7	200	132	9.5	40.9×57	13.6	6	●	●	●			●	●	●	●			●		I1
Anadex DP 9500	£1,397	M 9×9		●	●	●			9600	700	6,8	10,12,13.3	200	176	15.5	39×59.9	16	6	●	●	●			●	●	●	●			●		I1
Anadex DP 9500A	£1,397	M 7×9, 9×9, 13×9		●	●	●			9600	2700	6,8	10,12,13.3	200	176	15.5	40.9×70.3	16	6	●	●	●			●	●	●	●			●		I1
Anadex DP 9500L	£1,295	M 7×9, 9×9		●	●	●			9600	700	6,8	10	150	132	15.5	39×59.9	16	6			●				●	●	●			●		I1
Anadex DP 9501	£1,397	M 7×9, 11×9		●	●	●			9600	700	6,8	10,12.5,15,16.7	200	220	15.5	39×59.9	16	6	●	●	●			●	●	●	●			●		I1
Anadex DP 9501A	£1,397	M 7×9, 11×9		●	●	●			9600	2700	6,8	10,12.5,15,16.7	200	220	15.5	40.9×70.3	16	6	●	●	●			●	●	●	●			●		I1
Anadex DP 9620A*	£1,489	M 7×9, 9×9, 13×9		●		●			9600	1500	6,8	10,12,15,16.4	200	216	15.5	40.9×70.3	16	6	●	●	●			●	●	●	●			●		I1
Anadex WP 6000	£2,616	M up to 18×20		●		●			19200	4500	6,8,12,16	10,12,16.7	285	220	15.5	46.7×74.9	25	6	●	●	●	●		●	●	●	●		●	●	●	I1
ASP 3500	£977	M 9×7, 9×9		○		○			9600	80	6,8	10,12,16.5	180	217	14	61.5×40.5	19	6	●	●	●		●	●	●	●	●					M1
Brother HRI	£747	Daisywheel		○		○	○		9600	2000	4,5,6	10,12,15	35	198	16.5	38.1×71.2	16	8			●				●	●			●		●	J1
Canon AP400	£1,140	Daisywheel	●			●		1	19200	4000	4,6,8	10,12,15	25	197	15.5	50.8×48.2	18.5	6	●	●	●	●	●		●	●	●	●	●	●	●	D1
Centronics 159/4	£962	M 9×7				●			9600	768	6	5,8.18,10,16.36	150	80	10	38×35.6	10	5							●	●	●			●	●	B1
Centronics 150/4	£682	M 9×7				●		1	9600	768	6,8	10,12,16.36	150	132	9.5	38.1×35.5	9.1	3	●		●	●				●	●	●		●	●	R1
Centronics 152/4	£788	M 9×7				●		1	9600	708	6,8	10,12,16.5	150	217	9.5	38.1×35.5	9.1	3	●		●	●			●	●	●	●		●	●	R1

Centronics 154	£869	M 11×8		●		●			9600	2000	6,9,12,18	5,10,16.5	120	132	15	52.6×37.1	13	5	●		●			●	●	●	●			●		C1
Centronics 159/2	£881	M 9×7		●					N/A	768	6	5,8.18,10,16.36	150	132	10	38.1×35.6	10	5						●	●	●		●	●	●		B1
Centronics 351	£1,891	M 7×9		●	+	●			19200	2000	6,8	5,6,8.25,10,12,16.5	200	192	15	45.7×55.9	18	6	●	●	●		●		●	●	●	●	●	●	●		B1
Centronics 352	£1,966	M 7×8		●	+	●			19200	2000	6,8	5,6,7.5,8.25,13.2,15,16.5	200	218	14.5	55.9×45.7	18.1	6	●					●	●	●	●		●	●	●		C1
Centronics 353	£2,420	M 7×8			+	●			19200	4000	3,4,6,8,12	10,12,13.2,15,16.5	200	218	15	55.9×45.7	18.1	6	●		●			●	●	●	●		●	●	●		C1
Centronics 739/2	£710	M 11×9		●					2200	132	6	5,8.3,10,16.7	100	132	9	36.8×27.9	5.4	5	●			●		●			●	●	●		●	C1
Centronics 739/4	£786	M 11×9				●			9600	512	6	5,8.3,10,16.7	100	132	9	36.8×40.6	7.2	5	●			●		●			●	●	●		●	C1
Commodore 4022P	£454	M 6×7	●						N/A	N/A	2	5,10	40	80	10	36.8×33	9.9	3					●	●	●	●	●	●		●		C2
Commodore 8023	£1,029	M 5×8	●						N/A	N/A	2	5,10	150	250	15	51.4×36.8	11.6	3		●			●	●	●	●	●	●	●	●		C2
Data Products DP55	£1,687	Daisywheel				●		2	9600	1000	6,8	10,12,15	55	198	15	44.4×60.4	24	6	●	●	●	●		●	●	●	●	●	●		●	S1
Data Products M100	£1,790	M 9×9		+		+	1		N/A	N/A	6,8	5,8,10,16.5	140	218	16	67.5×59.4	27	6	●	●	●	●	●	●	●	●	●			●		S1
Data Products M120	£1,741	M 7×7		+		+	1		N/A	N/A	6,8	5,10,16.7	180	220	16	67.5×59.4	27	6							●	●	●			●		S1
Data Products M200	£1,979	M 7×7		+		+	1		N/A	N/A	6,8	5,10.8,16.7	340	340	16	67.5×59.4	27	6							●	●	●			●		S1
Data South DS180	£1,604	M 9×7	+	●	+	●		1	9600	2000	6,8	5,6,8.25,10,12,16.5	180	217	15.5	60.9×40.6	16	6	●	●	●		●	●	●	●	●			●		D2
Diablo SP1/P11	£2,127	Daisywheel				●			9600	256	6,8	10,15	40	198	16	56.9×46.3	27.2	6	●	●	●	●			●	●			●		●	M2
Diablo 630	£2,127	Daisywheel				●			9600	768	6,8,12	10,12,15	40	198	16.5	56.9×46.3	27	6	●	●	●	●			●	●	●			●	●	M2
DMP 100	£249	M 5×7		●		●			1200	2000	6,8	10.5	50	80	9.5	40.6×20.9	3.9	1	●	●	●		●	●		●	●			●	●	T1
DMP 200	£499	M 9×23		●		●			1200	2000	6,8	10	120	120	9.5	41.9×34.3	7.5	3	●	●	●	●	●	●	●	●	●	●		●	●	T1
DMP 400	£699	M 7×9, 9×9		●		●			1200	2000	6,8	10,12,16.7	140	220	15	61.9×40.4	19	5	●	●	●	●	●	●	●	●	●		●	●		T1
DMP 500	£1,099	M 23×9		●					9600	2000	6,8	10,12,16.7	220	220	15	58.4×33	12.7	5	●	●	●	●	●	●	●	●	●		●	●		T1
DMP 2100	£1,399	M		●		●			1200	2000	6,8,12	10,12,16.6	160	232	15	55.2×38.1	20	8	●	●	●	●	●	●	●	●	●			●		T1
DRE 8820	£895	M 9×7		○		○			9600	500	6,8	10,12.5,15,16.7	150	266	15.5	64.7×47.6	23	5	●		●				●	●	●	●		●	●	G1
DRE 8830	£1,300	M 9×7		○		○			9600	500	6,8	10,12,13.3,15,17	180	226	15.5	64.7×47.6	23	5	●		●				●	●	●	●		●	●	G1
DRE 8840	£1,370	M 9×7		○		○			9600	500	6,8	10,12,13.3,15,17	240	226	15.5	64.7×47.6	23	5	●		●				●	●	●	●		●	●	G1
DRE 8910	£1,585	M 9×7, 9×11		○		○			9600	500	6,8	10,12,13.3,15,17	160	226	15.5	64.7×47.6	23	5	●		●				●	●	●	●		●	●	G1
DRE 8925	£1,660	M 12×8, 12×20		○		○			9600	500	6,8	10,12,15,16.7	120	226	15.5	64.7×47.6	23	5	●		●				●	●	●	●		●	●	G1
DRH 80	£621	M 7×9		○		○			9600	256	6,8	10,12.5,15,17.5	80	140	8	41.5×30	7.5	4	●	●	●		●		●	●	●	●	●	●	●	T1
DRH 136	£776	M 7×9		○		○			9600	2000	6,8	10,12,15,16.5	120	224	15.5	48.6×30.3	10.5	3	●	●	●		●	●	●	●	●	●		●	●	T1
DRS 250	£1,431	M 7×9		○		○			19200	512	6,8	10,12,15	250	198	6	61×45	25	5	●	●	●		●	●	●	●	●			●		T1
DWP 410	£995	Daisywheel		●					9600	2000	6,8	10,12	25	160	16	60.3×19.6	16	5	●	●	●	●			●	●	●		●	●	●	T1
Epson MX80	£401	M 9×9		●	+	+		1	19200	256	6,8	5,8.25,10,16.5	80	132	10	40.6×38.1	5.5	3	●	●	●		●	●	●	●	●			●		E1
Epson MX80 FTT/3	£447	M 9×9		●	+	+		1	19200	256	6,8	5,8.25,10,16.5	80	132	10	40.6×38.1	7.7	3	●	●	●		●	●	●	●	●			●		E1
Epson MX82	£470	M 9×9		●	+	+		1	19200	256	8	17.2	80	159	10	40.6×38.1	7.7	3	●	●	●	●	●	●	●	●	●	●	●	●		E1
Epson MX100FT/3	£574	M		●	+	+		1	19200	256	8	16.5	100	233	15.5	59.7×40	10	3	●	●	●		●	●	●	●	●	●	●	●		E1
Facit 4510	£672	M 9×7		○	○	○			9600	712	6,8	6,12,16,17.5	100	132	11.5	42.5×34.8	9	5	●	●	●	●		●	●	●	●	●		●	●	A2
Facit 4525	£1,150	M 9×9		○	○	○			9600	512	6,8	5,8.5,10,17	280	132	11.5	46.5×35.6	13.5	5	●	●	●				●	●	●			●		A2
Facit 4542	£2,300	M 9×14		●	+	+			9600	800	6,8	10,12,15	250	232	18	64×45.7	40	5	●	●	●	●	●	●	●	●	●			●		A2
Fujitsu 830	£2,179	Daisywheel		+	●	●			1200	256	3,6,8	10,12,15	80	204	15	59.7×44.9	18	6	●	●	●	●		●	●	●	●		●	●	●	Z1
General Electric 2030	£961	M 9×7				+	1		1200	640	2,4,6,8,12	10,13,16.5	60	218	15.5	54.6×47.6	9.9	2	●						●	●	●	●		●	●	Z1
General Electric 2120	£1,751	M 9×7				+	1		1200	640	2,4,6,8,12	10,13,16.5	150	218	15.5	54.6×47.6	9.9	2	●						●	●	●	●		●	●	Z1
General Printer GP300	£2,287	M 9×9, 18×25				●		2	19200	380	6,8	10,12,15	300	120	13.5	52×44.5	20	5	●	●	●	●	●	●	●	●	●		●		●	I2
General Printer GP300L	£2,490	M 9×9, 18×25				●		2	19200	380	6,8	10,12,15	300	132	13.5	63.5×51.5	24	5	●	●	●	●	●	●	●	●	●		●		●	I2
Integrex	£914	M 7×5, 9×6	+	●		+			N/A	37	6,8	10	125	80	10	38.7×32.5	9.6	1					●	●			●			●		D3
ITT Swift 3342	£1,719	M 9×7			○	○			1200	640	2,3,4,6,8,12	10,13,16.5	150	240	15.5	56×47	10.4	6	●		●				●	●	●	●		●	●	I3
ITT Swallow	£914	M 9×7		○	○	○			1200	640	2,4,6,8,12	10,13,16.5	60	240	15.5	56×47	10	6	●		●				●	●	●	●			●	I3
Lear Siegler	£1,667	M 9×9		○	○	○			19200	2000	6,8	10,12	180	218	16	68.6×50.2	22.7	5	●		●	●	●		●	●	●			●		I4
Logabax LX213	£1,840	M 9×9		+		●			9600	4000	6,8	10,12,16.5	180	218	15	57.1×43.2	17	5	●	●	●				●	●	●			●		T3
Logabax LX217	£2,242	M 9×9		+		●			9600	400	6,8	10,12,16.5	180	218	15	57.1×43.2	17	5	●	●	●				●	●	●		●	●		T3
Micro Peripherals 99G	£517	M 9×7, 11×9		●		●			9600	2048	6,8	10,12,16.5	100	136	9.5	41.1×27.3	6.7	2	●	●	●			●	●	●	●	●	●	●	●	T3
Micro Peripherals 150G	£918	M 9×7, 11×9		●		●			9600	8192	6,8	10,12,16.5	150	226	15	58.4×39.9	11.2	2	●	●	●		●	●	●	●	●			●		T3
MT120 I	£600	M 9×7	+	●	+	+			9600	132	6,8	10,12.5,16.6,20	160	132	10	34.3×24.1	7.5	4		●	●		●	●	●	●	●	●	●	●	●	M3
MT120 L	£765	M 9×7	+	●	+	+			9600	132	6,8	10,12.5,16.6,20	160	132	10	34.3×24.1	7.5	4		●	●		●	●	●	●	●	●	●	●	●	M3
MT1802 I	£1,845	M 7×9	+	○	+	○			9600	218	6,8	10,16.6	200	218	16	55.9×76.2	8.6	5			●				●	●	●			●		M3
MT1802 L	£2,205	M 7×9	+	○	+	○			9600	218	6,8	10,16.6	200	218	16	55.9×76.2	8.6	5			●				●	●	●			●		M3
MT440 I	£1,966	M 9×7		●	+	+			9600	220	3,4,6,8,12	10,12.5,16.6	400	220	16	66×45.7	36	5			●				●	●	●			●		M3
MT440 L	£2,185	M 9×7		●	+	+			9600	220	3,4,6,8,12	10,12.5,16.6	400	220	16	66×45.7	36	5			●				●	●	●			●		M3

PRINTERS

Make & Model	Price inc VAT	Printhead type (M = matrix)	INTERFACES ● inc in price, ○ = options at extra cost (+)						Max baud rate	Buffer Memory Size (in characters)	Lines per inch	Characters per inch	Max print Speed (CPS)	Max print positions	Max paper width in inches	Size (base area in cms)	Weight (in kilos)	Max Copies	Underlining	Bold Type	True Descenders	Proportional Spacing	Block Graphics	High Resolution Graphics	Bi Directional	Logic Seeking	Feed Method					Distributor
			I-EEE	Centronics	20ma	RS232	Others ●	Others (+)																			Fan Fold	Roll	Cut Sheet	Tractor	Frictional	
MT420 I	£882	M 9×7		●	+	+			9600	220	3,4,6,8,12	10,12.5,16.7	200	220	16	66×45.7	36	5		●	●	●		●	●	●	●			●		M3
MT420 L	£954	M 9×7		●	+	+			9600	220	3,4,6,8,12	10,12.5,16.7	200	220	16	66×45.7	36	5		●	●	●		●	●	●	●			●		M3
MT140 I	£1,593	M 9×7	+	●	+	+			9600	218	6,8	10,12.5,16.6,20	160	218	16	48.3×24.1	7.5	4		●	●		●	●	●	●	●		●	●	●	M3
MT140 L	£1,869	M 9×7	+	●	+	+			9600	218	6,8	10,12.5,16.6,20	160	218	16	48.3×24.1	7.5	4		●	●		●	●	●	●	●		●	●	●	M3
Newbury Labs 1550	£747	M 9×7		○		○			9600	2000	6,8	5,6,8.5,10,12,17	120	230	15.5	55.9×30.5	11	3	●	●	●	●	●	●	●	●	●	●	●		●	N1
Newbury Labs 8510A	£552	M 9×7		○		○			9600	3000	6,8	5,6,8.5,10,12,17	120	132	10	55.9×28.6	8.5	3	●	●	●	●	●	●	●	●	●	●		●	N1
Newbury Labs NL40	£1,478	Daisywheel		○	○	○			2400	2000	6,8	10,12	40	163	15.5	55.9×43.2	14	2	●	●	●	●			●	●	●	●	●	●	N1
OKI Microline 80	£242	M 5×7		●		+			9600	256	6,8	5,10,16.5	80	132	9.5	34.2×24.5	6.5	4					●				●	●		●	●	X1
OKI Microline 82A	£425	M 9×7		●	●	+			1200	132	6,8	5,8.3,10,16.5	120	132	9.5	36.1×32.8	8.9	4	●		●		●		●	●	●	●		●	●	X1
OKI Microline 83A	£608	M 9×7		●	●	+			1200	132	6,8	5,8.3,10,16.5	120	132	15	51×32.8	14	3	●		●		●		●	●	●	●		●	●	X1
OKI Microline 84	£975	M		○	○	●			4800	132	6,8	5,8.3,10,12,17	200	231	15	51×32.8	14	3	●	●	●	●		●	●	●	●		●	●	●	X1
Olivetti DM5050	£575	M 7×9		●	+	+		4	9600	1000	6	10,12.5,16.5	100	132	9	11.6×30	7.5	2	●	●	●			●		●	●	●		●	●	B2
Olivetti DM5100	£1,033	M 7×9	○	○	○	○			9600	256	6	10,12,16.5	140	220	14.75	59.2×40.1	17	4	●	●	●		●		●	●	●			●		B2
Olivetti DM5200	£1,351	M 7×9	●	+	+	+			9600	256	6	10,12,16.5	200	220	19.75	59.2×40.1	17	4	●	●	●		●		●	●	●			●		B2
Olivetti DY-211	£862	Daisywheel	+	●	+	●			9600	1000	6	10,12,15	29	198	17	54.1×32.8	16.3	4	●	●	●	●			●	●	●	●	●	●	B2
Olivetti DY-311	£1,322	Daisywheel	+	○		○			9600	1000	6	10,12,15	39	225	17.25	60×50	17	4	●	●	●	●			●	●	●	●		●	●	B2
Olivetti JP101	£420	Dry Ink Jet		●	+	+			9600	1000	6,8	10,12,18	50	147	9	39×26.8	5.2	1	●				●	●	●	●	●	●			●	B2
Olivetti TH240	£661	Thermal 5×7			+	●			9600	1000	6	10	240	80	8.75	40.1×34	7.5	1	●	●				●		●		●			●	B2
Olympia ESW102RO	£1,917	Daisywheel	+	+	+	●			19200	4000	6	10,12,15	24	141	17	52.8×37	13	6	●	●	●	●			●	●	●		●	●	●	I5
Olympia ESW103KSR	£1,263	Daisywheel	+	+	+	●			19200	4000	6	10,12,15	24	212	17	52.8×43.1	14.5	6	●	●	●	●			●	●	●		●	●	●	I5
Olympia ESW3000RO	£1,306	Daisywheel	○	○		○			19200	4000	3,4,6	10,12,15	50	225	17	60.4×40.8	19.5	6	●	●	●	●			●	●	●		●	●	●	I5
Phillips Mullard GP300	£2,287	M		+		●			19200	512	3,4,6,8,12	10,12,15	300	180	14.4	64.5×52.3	24	6	●	●	●	●	●		●	●	●	●	●	●	●	R2
Printex 920	£2,012	M		+		●			9600	1792	6,8,12,16	10,12,13.3,16.7	340	227	16	59×42.5	20	4	●	●	●		●	●	●	●	●			●		T3
Qume Sprint 9/35	£1,892	Daisywheel				+	1		9600	500	6,8	10,12,15	35	198	15	61.3×49.9	19	3	●	●	●	●	●		●	●	●	●	●		●	Q1
Qume Sprint 9/45	£1,966	Daisywheel				+	1		9600	500	3,6,8	10,12,15	45	198	15	61.7×42.5	20.4	3	●	●	●	●	●	●	●	●	●	●	●		●	Q1
Qume Sprint 9/55	£2,403	Daisywheel				+	1		9600	500	3,6,8	10,12,15	55	198	15	61.7×42.5	20.4	3	●	●	●	●	●		●	●	●	●	●		●	Q1
Rair Decwriter III	£2,261	M 7×7			+	●			9600	1000	2,3,4,6,8,12	5,6,6.6,8.25,10,13.2,16.5	180	132	15	69.9×60.9	46.4	3	●						●	●	●		●			R1
Rair Decwriter IV AA	£1,200	M 7×9			+	●			300	256	2,3,4,6,8,12	5,6,6.6,8.25,10,13.2,16.5	30	127	15	57.1×39.4	11.3	3				●					●	●				●	R1
Rair 630	£1,940	Daisywheel			+	●			9600	768	6,8	10,16.5	40	196	15	59.9×46.4	27.2	2	●		●	●			●	●	●	●	●	●	●	R1
Rair 820	£1,529	M 9×7			+	●			9600	1280	6,8	10,16.5	150	132	15	66×53.4	18.2	6	●		●				●	●	●	●		●	●	R1
Rair Centronics 150/4	£722	M 9×7		+		●			9600	N/A	6	10	150	132	10	38.1×35.6	9	2		●					●	●	●	●	●	●	●	R1
Rair/Texas Instruments 743	£1,437	Thermal				●			300	N/A	6	10	30	80	8.5	39.1×40.6	6.1	1	●										●		●	R1
Ricoh RP1300 Flowriter	£1,144	Daisywheel	○	○		○			9600	200	8	10,12,15	37	163	15	59.3×33.2	14	7	●	●	●	●	●	●	●	●	●	●	●	●	●	A1
Ricoh RP1600 Flowriter	£1,782	Daisywheel	○	○		○			9600	2000	8	10,12,15	60	163	15	62.5×35.5	22	7	●	●	●	●	●	●	●	●	●	●	●	●	●	A1
Ricoh RP1600S	£1,667	Daisywheel	+	+		●			9600	4000	6,8	10,12,15	65	204	13.5	63.5×36.2	27	7	●	●	●	●	●		●	●	●	●			●	M4
Sanders S700	£2,875	M		●		●			9600	2000	6,8	6,10,12,15,17,18	450	234	14.5	47×56.9	23.6	5	●	●	●	●	●	●	●	●	●		●		●	A2
Seikosha GP100A	£247	M 5×7	+	●	+	+			9600	256	6	6,12	50	80	10	42.7×23.8	4.5	3		●				●			●			●		D4
Smith Corona TP1	£557	Daisywheel		○		○			19200	N/A	3,4.5,6	10,12	120	126	13	49.5×31.5	8.4	5	●	●	●						●	●	●		●	D1
Sord SLP160	£724	M		●					9600	136	6,8,9	10,12	120	136	15	51×36	13	5	●	●	●		●	●	●	●	●			●	●	S12
Sord SWP20	£1,444	Daisywheel		●		+			9600	2000	6,8	10,12,15	16	132	15	66×44.7	22	5	●	●	●	●			●	●	●		●		●	S2
Star DP-8480	£251	M		●		+			2400	132	6,12	10,12,16.7	100	132	10.5	39.4×32.4	8.5	2	●		●		●		●	●	●		●	●	●	S3
Systime Systerm	£1,909	M				●			9600	256	6,8	10	120	132	16	71.7×61	53	6			●		●		●	●	●		●			S4
Systime Sysprint-P	£1,714	M		●					9600	256	6,8	10	150	132	16	71.7×61	50	6			●		●		●	●	●		●			S4
Systime Sysprint-S	£1,599	M				●			9600	256	6,8	10	120	132	16	71.7×61	53	6			●		●		●	●	●		●			S4
Tandy TRS 80 DW2	£1,299	Daisywheel		●					9600	2000	6	10,12	43	163	16.5	62.4×20.4	27	4	●	●	●	●				●	●		●	●	●	T1
Texas Instruments 743	£1,271	Thermal 7×5			●	●			300	N/A	6	10,17	30	80	8.5	39.1×40.6	6	1										●			●	D5
Texas Instruments 745	£1,470	Thermal				●			300	256	6	10,17	30	80	8.5	39.1×40.6	13.5	1										●				R1

PRINTERS

Make & Model	Price inc VAT	Printhead type (M = matrix)	INTERFACES ● inc in price, ○ = options at extra cost (+)						Max baud rate	Buffer Memory Size (in characters)	Lines per inch	Characters per inch	Max print Speed (CPS)	Max print positions	Max paper width in inches	Size (base area in cms)	Weight (in kilos)	Max Copies	Underlining	Bold Type	True Descenders	Proportional Spacing	Block Graphics	High Resolution Graphics	Bi Directional	Logic Seeking	Feed Method					Distributor
			I-EEE	Centronics	20ma	RS232	Others ●	Others (+)																			Fan Fold	Roll	Cut Sheet	Tractor	Frictional	
Texas Instruments 781	£1,259	Thermal 7×5			●	●			9600	256	6	10,17	120	80	8.5	40.6×15.24	8.5	1							●	●		●			●	D5
Texas Instruments 810	£1,369	M 9×7		+	+	●			9600	256	6,8	5,8,10,16.5	150	132	15.5	65.4×50.8	25	9							●	●	●				●		D5
Texas Instruments 820	£1,438	M 9×7			○	○			9600	2000	6,8	5,8,10,16.5	150	218	15.5	64×45.7	40	5							●	●	●				●		D5
Texas Instruments 840	£847	M 9×9			+	●			9600	256	6,8	10,16.5	75	220	15	57.6×43.2	11.3	3							●	●	●	●			●	●	R1
TRD 170S	£834	Daisywheel		○		○			19200	256	6	10,12,15	17	132	15.5	50.8×33	13	6	●	●	●	●			●	●	●					●	T2
Toshiba T1350	£1,898	M		○		○			9600	256	6	10,12	192	192	15	55×38	19.9	3	●	●	●	●	●	●	●	●	●	●	●	●	●	T4
Walters WM2000	£477	M 9×9	+	●	+	+			19200	750	6,8,12	5,6.6,8.3,10,13.3,16.6	128	132	10	43.9×33.5	12	4	●	●	●		●	●	●	●	●			●		W1
Walters WM4000	£713	M 9×9	+	●	+	+			19200	1500	6,8,12	5,6.6,8.3,10,13.3,16.6	150	220	15	63×39	13	5	●	●	●		●	●	●	●	●			●		W1
ZX Printer	£40	Electrical						1	N/A	N/A	9	32	50	32	4	14×4.6	N/A	1			●		●	●				●			●	S5

MONITORS

These have been split into **colour** and **monochrome**.

Screen size is a diagonal measurement in inches. Nearly all monochrome monitors accept a **composite video** signal from the computer and most computers are equipped with composite video output. Colour monitors feature a wider range of **signal** systems than mono and it is important to match the output of your computer to the input of the monitor.

An **audio channel** will enable sound to be output from a speaker inside the monitor. **Mono tint** refers to the colour of the text on a mono monitor. Some monitors come with an **anti-glare filter** to relieve operator discomfort.

Band width refers to the frequency range of signals to which the monitor can respond in MegaHertz. **Dot resolution** indicates the number of dots which can be displayed across the screen: the more dots, the sharper the picture.

Dimensions indicates the area the unit occupies on the desktop.

COLOUR MONITORS

Make & Model	Price inc VAT	Screen size (in inches)	Signal					Audio channel	Anti-glare filter	Band width (in MHz)	Dot resolution	Dimensions (cms)	Weight (kilos)	Distributor
			Modulated PAL	Unmodulated PAL	TTL RGB	75 Ohm linear	32 bit 4 bit TTL							
Crofton C1401	£300	14			●					10	600	37×42	10	C4
HM 2713	£3,120	13			●					25	720	54×40	36	B1
HM 2719B	£2,553	19			●					25	960	50×49	46	B1
HM 2719C	£3,042	19			●					25	960	50×49	46	B1
HM 3619	£3,548	19			●					45	1280	50×44	48	B1
Lion Cub 1431-TTL	£286	14			●					7	585	65×57.5	11.5	S6
Lion Cub 1436	£316	14					●			7	585	65×57.5	11.5	S6
Lion Cub 1439	£339	14				●				7	585	65×57.5	11.5	S6
Lion Cub 1441-TTL	£546	14			●					15	585	65×57.5	11.5	S6
Lion Cub 1445	£633	14				●	●			15	895	65×57.5	11.5	S6
Lion Cub 1449	£604	14				●				15	895	65×57.5	11.5	S6
Lion Cub 1451-TTL	£430	14			●					10	653	65×57.5	11.5	S6
Lion Cub 1455	£483	14				●	●			10	653	65×57.5	11.5	S6
Lion Cub 1459	£459	14				●				10	653	65×57.5	11.5	S6
Lion Cub 2031-TTL	£344	20			●					7	585	65×57.5	11.5	S6
Lion Cub 2035	£431	20				●	●			7	585	65×57.5	11.5	S6
Lion Cub 2036	£390	20					●			7	585	65×57.5	11.5	S6
Lion Cub 2039	£371	20				●				7	585	65×57.5	11.5	S6

Make & Model	Price inc VAT	Screen size (in inches)	Signal					Audio channel	Anti-glare filter	Band width (in MHz)	Dot resolution	Dimensions (cms)	Weight (kilos)	Distributor
			Modulated PAL	Unmodulated PAL	TTL RGB	75 Ohm linear	32 bit 4 bit TTL							
Lion Cub 2051-TTL	£646	20			●					10	940	65×57.5	11.5	S6
Luxor Digital	£574	14			●			●	●	25	800	N/A	15.7	P1
Luxor Linear I	£597	14				●		●	●	25	800	N/A	15.7	P1
Luxor Linear II	£643	14			●			●	●	25	800	N/A	15.7	P1
Microtech 14	£402	14		●	●	●		●		18	585	33.7 × 40.8	12.6	M6
TM 22	£329	6				●		●		5.5	N/A	22×34.5	4.1	J3
VM 14 PSN	£378	14				●		●		5.5	300	47×40	13.6	J3
Wolf Cub 1435-TTL	£358	14				●	●			7	653	65×57.5	11.5	S6
Wolf Cub 1446-TTL	£587	14					●			15	895	65×57.5	11.5	S6
Wolf Cub 1456	£454	14					●			10	653	65×57.5	11.5	S6

MONOCHROME MONITORS

Make & Model	Price inc. VAT	Screen size	Composite video	Audio channel	Mono tint	Anti-glare filter	Band width (MHz)	Dot resolution	Dimensions (cms)	Weight (kilos)	Distributor
AVT DM 210G	£138	12	●		Green	●	12	750	30.8×29.6	9.5	L1
EG 100	£77	12	●		Green		8	700	37.5×29	8	L1
EG 101	£91	12	●		Green		12	700	37.5×29	8	L1
LEDM 091D	£99	9	●		B&W	●	12	750	22×24	5.4	L1
LEDM 0910	£121	9	●		Green	●	12	750	22×24	5.4	L1
Luxor 10	£212	10	●		Orange	●	22	625	N/A	8	P1
Luxor 15	£283	15	●		Orange	●	22	625	N/A	13	P1
M9	£131	9	●		Green		15-22	650	22.4×25.7	5.7	P1
M12	£144	12	●		Green		15-22	800	29.3×30	9.3	P1
Novex	£114	12	●		Green		12	750	N/A	N/A	P1
N12 1003	£112	12	●		Green		24	800	23×26.5	7	P1
Prince	£126	12	●		Green		24	800	33×50	7	C4
PM 102	£126	9	●		Green	●	24	800	22×28	7	C4
PM 1201	£138	12	●		Green		24	800	33×50	7	C4
Zenith ZVM121	£99	12	●	●	Green	●	15	N/A	29×29	6.5	P2

DISK DRIVES

This section is divided into categories covering 5¼in and 8in floppy disks.

Disk data **capacity** is measured in kilobytes (K): one kilobyte = 1,024 characters. A **no of disks** column is included because some disk units contain two disk drives.

Manufacturers can vary the number of disk data **tracks** and these are divided into sectors. This **sectoring** system allows the information to be stored and retrieved by reference to a timing mark on the disk so the computer can keep track of its rotation. The system can be hard, where reference is kept by a hole in the disk, or soft, where the disk position is monitored by magnetic signals.

Some drives have one read/write head for each side of the disk so the buyer has a choice between **single or double-sided** drives. **BS** means that the drives are both single and double-sided.

As disk technology advanced it became possible to cram more data onto the floppy so drives will feature either **single or double** (data) **density. BD** means that the drives are both single and double density.

The interface acts as an interpreter so the computer and disk can exchange information. Each device must have the same interpreter before a useful cable connection can be made. The **connect to** column allows you to match the disk interfaces to those included in the disk drives or available at extra cost.

5¼" DISK DRIVES

Make and Model	Price inc VAT	Capacity	No. of disks	Tracks	Sectoring	Sides and density	Connects to: I-EEE	RS232	BBC	Apple II	St. Shugart	Nasbus	Gemini	20ma	Others	Distributor
Apple II	£399	143K	1	35	16	SS.SD				●						P2
Atari	£299	90K	1	40	Soft	SS.SD									●	A4
BASF 6106	£195	500K	1	48	Both	SS.BD					●					B6
BASF 6108	£240	500K	1	48	Both	DS.BD					●					B6
BASF 6118	£279	1Mb	1	96	Both	DS.BD					●					B6
Canon X8300	£600	640K	2	80	Soft	DS.DD									●	C5
CD 40	£679	400K	2	40	Both	SS.BD									●	C6
CD 50A	£424	500K	2	40	Both	SS.BD					●					C6
CD 50E	£569	1Mb	2	80	Both	SS.BD					●					C6
CD 50F	£712	2Mb	2	80	Both	DS.BD					●					C6
CD 80	£765	800K	2	80	Both	SS.BD									●	C6
CD 80D	£949	1.6Mb	2	80	Both	DS.BD									●	C6
Commodore 2031	£454	171K	1	35	Soft	SS.DD	●									C2
Commodore 4040	£799	343K	2	35	Soft	SS.DD	●									C2
Commodore 8050	£1,029	1Mb	2	77	Soft	SS.DD	●									C2
Commodore 8250	£1,489	2Mb	2	154	Soft	DS.DD	●									C2
Commodore VIC 1541	£345	171K	1	35	Soft	SS.DD									●	C2
Control Data 9408	£221	250K	1	40	Both	SS.BD					●					C7
Control Data 9409	£272	500K	1	40	Both	DS.BD					●					C7
Control Data 9409T	£420	1Mb	1	80	Both	DS.BD					●					C7
Control Data ZL141	£225	250K	1	40	Both	SS.DD			●							M5
Control Data ZL141B	£175	250K	1	40	Both	SS.DD			●							M5
Control Data ZL142	£360	500K	2	40	Both	SS.DD			●							M5
Control Data ZL241B	£240	500K	1	40	Both	DS.DD			●							M5
Control Data ZL291	£380	1Mb	1	80	Both	DS.DD			●							M5
Control Data ZL291*	£405	500/1Mb	1	40/80	Both	DS.DD			●							M5
Control Data ZL291B	£320	1Mb	1	80	Both	DS.DD			●							M5
Control Data ZL292	£640	2Mb	2	80	Both	DS.DD			●							M5
CS 40	£482	200K	1	40	Both	SS.BD									●	C6
CS 50A	£229	250K	1	40	Both	SS.BD					●					C6
CS 50E	£305	500K	1	80	Both	SS.BD					●					C6
CS 50F	£397	1Mb	1	80	Both	DS.BD					●					C6
CS 80	£523	400K	1	80	Both	SS.BD									●	C6
CS 80D	£627	800K	1	80	Both	DS.BD									●	C6
Cumana AS100	£252	200K	1	35	Soft	SS.BD				●						C6
Cumana DA8035	£857	655K	2	80	Soft	SS.BD				●						C6
EG 401AT	£370	102K	2	40	Soft	SS.BD					●					L1
Gemini 825	£403	400K	1	80	Soft	SS.DD						●				G2
Gemini 825	£518	800K	1	160	Soft	DS.DD						●				G2
Gemini 825	£661	800K	2	80	Soft	SS.DD						●				G2
Gemini 825	£776	1.6Mb	2	160	Soft	DS.DD						●				G2
Lowe EG 400AT	£426	200K	2	40	Soft	SS.BD					●					L1
Lowe EG 400T	£253	102K	1	40	Soft	SS.BD					●					L1
M 4853	£311	1Mb	1	80	Soft	DS.DD					●					A3
M 4854	£368	1.6Mb	1	77	Soft	DS.DD					●					A3
Megastore MIOS	£1,034	1.2Mb	2	80	Soft	DS.DD				●					●	V1
Multi Floppy Drive	£592	8Mb	5	770	Soft	SS.DD	●									H1
RM MDS-1	£1,950	144K	1	40	Soft	DS.SD		●							●	R3
RM MDS-2	£2,147	288K	2	40	Soft	DS.SD		●							●	R3
Scorpio 8	£863	8Mb	5	770	Soft	SS.DD	●									H1
Sharp MZ80 FB	£856	560K	2	70	Soft	DS.DD									●	S7
Tandy Colour	£449	175K	1	40	Soft	SS.DD									●	T1
Tandy 26-1160	£299	75K	4	40	Soft	SS.SD					●					T1
Tandy 26-3023	£299	156K	4	35	Soft	SS.DD					●					T1
Tandy Model 1	£389	90K	1	35	Soft	SS.SD									●	T1
Tandy Model 111	£369	175K	2	40	Soft	SS.DD									●	T1
TM 101-4	£282	1Mb	1	160	Soft	SS.DD	●									H1
TM 102-2	£393	2Mb	1	160	Soft	SS.DD	●									H1
TM 848-1	£389	800K	1	77	Soft	SS.DD	●									H1
TM 50-1	£147	250K	1	40	Soft	SS.DD	●									H1
TM 100-1	£158	250K	1	40	Soft	SS.DD	●									H1
TM 100-2	£221	500K	1	80	Soft	DS.DD	●									H1
TM 100-4/4M	£247	1Mb	1	160	Soft	DS.DD	●									H1
Tracker 1	£373	1Mb	2	80	Soft	SS.DD					●					D7
Tracker 2	£497	2Mb	2	80	Soft	DS.DD					●					D7

8" DISK DRIVES

Make and Model	Price inc VAT	Capacity	No. of discs	Tracks	Sectoring	Sides and density	Connects to: I-EEE	RS232	BBC	Apple II	St. Shugart	Nasbus	Gemini	20ma	Others	Distributor
ACP 700 (AC)	£293	1Mb	1	77	Soft	DS.DD									●	E2
ACP 750 (DC)	£316	1Mb	1	77	Soft	DS.DD									●	E2
ACP 1500 (DC)	£403	2Mb	1	77	Soft	DS.DD									●	E2
Caldisk 142M	£465	500K	1	77	Both	SS.BD									●	E2
Caldisk 143M	£522	1.2Mb	1	77	Both	DS.BD					●					F1
Caldisk 143M-1	£465	500K	1	77	Both	SS.BD					●					F3
Commodore 8280	£2,760	987K	2	77	Soft	DS.DD	●									C2
Canon X 8330	£1,200	2Mb	2	153	Soft	DS.DD									●	C5
Control Data 9404B	£684	800K	1	77	Both	SS.BD					●					M5
Control Data 9406-4	£1,144	1.6Mb	1	77	Both	DS.BD					●					M5
Eicon FD8/1D/DD	£1,438	1Mb	1	77	Soft	SS.DD				●						E3
Eicon FD8/1D/SD	£1,397	500K	1	77	Soft	BS.SD				●						E3
Eicon FD8/2D/FBR	£1,740	1Mb	2	77	Soft	DS.SD									●	E3
Eicon FD8/2D/DD	£2,013	2Mb	2	77	Soft	SS.DD				●						E3
Eicon FD8/2D/SD	£1,972	1Mb	2	77	Soft	SS.SD				●						E3
Eicon FD8/1D/FBR	£1,240	500K	1	77	Soft	DS.SD									●	E3
F 311	£1,725	1.2Mb	2	76	Soft	DS.SD									●	B5

8" DISK DRIVES

Make and Model	Price inc VAT	Capacity	No. of disks	Tracks	Sectoring	Sides and density	Connects to: I-EEE	RS232	BBC	Apple II	St. Shugart	Nasbus	Gemini	20ma	Others	Distributor
F 320	£2,300	2.4Mb	2	76	Soft	DS.DD									●	B5
M 2894	£499	1.6Mb	1	77	Soft	DS.DD					●					A3
M 2896	£493	1.6Mb	1	77	Soft	DS.DD					●					A3
Megastor 11 DD	£1,133	2Mb	2	77	Soft	DS.DD				●						V1
Megastor 11SD	£1,018	1Mb	2	77	Soft	DS.SD				●					●	V1
Megastor 111	£1,121	2Mb	2	77	Soft	DS.DD				●					●	V1
R.M. FDS-2	£3,789	1Mb	2	77	Soft	DS.SD		●							●	R3
Tandy Model 11	£999	486K	1	77	Soft	DS.SD.									●	T1
Tandy Model 16	£949	1.2Mb	1	77	Soft	DS.DD									●	T1
Tandy Model 16	£1,549	2.5Mb	2	77	Soft	DS.DD									●	T1

MODEMS

A modem interfaces a computer and the telephone system so computers can communicate over long distances. It converts data to electrical pulses or sounds that can be sent down the line. A modem can be connected to the line directly or acoustically. A **D** in the **connection** column represents direct link, while **A** indicates acoustic. The acoustic coupler is like a female telephone handset with a speaker in the coupler opposing the phone's mouthpiece and a microphone opposing the earpiece. A **B** in this column indicates that both methods of attachment are available. **Baud** rate shows the speed with which the data is transmitted.

The modem must be connected to the computer through an interface. The **interface** column lists the main interfaces featured on each modem. **Asynchronous** means that data may be transferred at intervals as available or as needed. **Synchronous** data is transmitted at regular intervals. **Simplex** transfers data in one direction, while **Half duplex** can transmit/receive in either direction, but not simultaneously. **Full duplex** transmits and receives information in both directions at once.

Some modems can **originate** a call or start a two-way conversation. **Answer** means they can respond to a call from another computer.

Make and Model	Price inc VAT	Connection	Data Rates (baud)	Interface	Others	Capabilities: Asynchronous	Synchronous	Simplex	Half Duplex	Full Duplex	Originate	Answer	Distributor Code
AJ 311	£320	B	300	RS232		●			●	●	●	●	A5
AJ 1222	£736	D	1200	RS232		●	●			●	●	●	A5
AJ A211	£263	A	300	RS232		●			●	●	●		A5
AJ 1234	£684	A	1200	RS232		●	●			●	●		A5
AJ 1256	£684	B	1200	RS232		●	●			●	●	●	A5
AM 211	£387	B	300	RS232		●			●	●	●		A5
Bermac 1200/1 Model A	£414	D	1800	RS232		●			●		●		B3
Bermac 1200/1 Model B	£460	D	1800	RS232		●			●		●	●	B3
CCITT CAT	£228	A	300	RS232/V24		●			●	●	●	●	D8
CDSV22	£719	D	1200	RS232/V24		●	●			●	●	●	D8
DSL2123	£329	D	300/1200	RS232/V24		●			●	●	●	●	D8
Sendata 700 Series A	£253	A	300	RS232, 20ma	1	●				●	●	●	B4
Sendata 700 Series B	£224	A	300	RS232, 20ma	1	●				●	●		B4
Sendata 700 Series C	£309	A	600-1200	RS232, 20ma	1	●			●		●	●	B4
Sendata 700 Series D	£309	A	75-1200	RS232, 20ma	1	●				●	●	●	B4
Sendata 700 Series E	£149	A	300-1200	RS232, 20ma	1	●		●			●		B4
Racal 126 LS1	£782	D	2400	V24			●			●	●	●	R2
Racal MPS 3021	£295	D	300	V24		●				●	●	●	R2
Racal MPS 1222	£678	D	1200	V24		●	●			●	●	●	R2

PLOTTERS

Plotters use a pen to put graphics or characters on paper under the command of a computer. They are usually one of two types—flatbed or drum. A **flatbed** holds the paper flat while the pen draws on it in two dimensions. A **drum** plotter turns the paper vertically on a cylinder while the pen moves horizontally. Most plotters can change pens during operation so a variety of colours and line thicknesses are available. **Max pens** indicates the number of pens in operation or on standby. Dimensions of the paper to be used are listed under **paper size. Maximum plotting speed** measures the distance in millimetres per sec covered by the pen. **Interfaces** are included in the basic price or come at extra cost.

Make and Model	Price inc VAT	Type	Max Pens	Paper Size	Maximum Plotting Speed in secs.	Interface (+ at extra cost)	Distribution
Calcomp 81	£3,392	Flat	8	A3	30cm	RS232 or IEEE	C3
HP 7470A	£1,317	Drum	2	A4	38.1cm	RS232 (IEEE+)	H2
PD4	£585	Flat	1	A4	700mm	(IEEE+)	J2
Strobe 100	£662	Drum	1	A4	7.6cm	(RS232, Parallel+)	D6
TRS-80 Pen Plotter	£1,399	Flat	6	A4	6.8cm	RS232	T1
Watanabe WX 4633	£2,772	Flat	10	A3	250mm	(Centronics, RS232, IEEE+)	E4
Watanabe WX 4634	£2,515	Flat	2	A3	250mm	(Centronics, RS232, IEEE+)	E4
Watanabe WX 4635	£2,301	Flat	1	A3	250mm	(Centronics, RS232, IEEE+)	E4
Watanabe 4636	£3,074	Flat	10	A3	400mm	(Centronics, RS232, IEEE+)	E4
Watanabe 4637	£2,862	Flat	2	A3	400mm	(Centronics, RS232, IEEE+)	E4
Watanabe 4638	£2,635	Flat	1	A3	400mm	(Centronics, RS232, IEEE+)	E4
Watanabe WX 4671	£1,129	Flat	1	A3	50mm	Parallel (RS232, IEEE+)	E4
Watanabe 4675	£1,638	Flat	6	A3	50mm	Parallel (RS232, IEEE+)	E4
Watanabe 4731	£1,761	Drum	4	A3	200mm	(Centronics, RS232, IEEE+)	E4

DISTRIBUTORS

A1 Appropriate Technology, 01-625 5575 **A2** Advent Data Products, Melksham 706289 **A3** Altex Microcomputers Ltd, Reading 791579 **A4** Atari International (UK), Slough 33344 **A5** Anderson Jacobson Ltd, Slough 25172
B1 Bytech, Reading 61031 **B2** British Olivetti, 01-785 6666 **B3** Barron McCann, Biggleswade 316286 **B4** Bencom Sendata (UK), 01-940 1386 **B5** Baydel Ltd, Leatherhead 378811 **B6** BASF, 01-388 4200
C1 Centronics, 01-581 1011 **C2** Commodore Business Machines, Slough 79292 **C3** Calcomp Ltd, Bracknell 50211 **C4** Crofton Electronics, 01-891 1923 **C5** Canon (UK) Ltd, 01-680 7700 **C6** Cumana, Guildford 503121 **C7** CBL, Reading 792097
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F1 Fastcol, Reading 791557
G1 Geveke Electronics, Woking 26331 **G2** Gemini Micros, Amersham 28321
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J1 Jones & Brother, 061-330 6531 **J2** J J Lloyd Instruments, Locksheath 4221 **J3** JVC, 01-450 2621
L1 Lowe Electronics, Matlock 4995
M1 Mitsui & Co Ltd, 01-600 1777 **M2** Modata, Tunbridge Wells 41555 **M3** Mannesmann Tally Ltd, Reading 788711 **M4** Micropute, Macclesfield 615384 **M5** Microware, 01-272 6237 **M6** Microtech Leeds, Leeds 679964
N1 Newbury Data Recording, Newbury 48864
P1 Phoenix Technology, 01-737 3333 **P2** Pete & Pam Computers, Rossendale 227011
Q1 Qume (UK) Ltd, Reading 584646
R1 Rair Ltd, 01-836 6921 **R2** Riva Terminals, Woking 71001 **R3** Research Machines Ltd, Oxford 249866
S1 Sintron Electronics, Reading 875464 **S2** Sord, 01-930 4214 **S3** Stotron, Coventry 613521 **S4** Systime, Leeds 702211
S5 Sinclair Research, Camberley 681666 **S6** Silicon Express, Leicester 374917 **S7** Sharp Electronics, 061-205 2333
T1 Tandy Company, Walsall 648181 **T2** Triumph Adler, 01-250 1717 **T3** Technology For Business, 01-837 1271 **T4** Toshiba Office International, Sunbury-on-Thames 85666
V1 Vlasak, High Wycombe 448633
W1 Walters Microsystems Int Ltd, High Wycombe 445175
X1 X-Data Ltd, Slough 723331
Z1 Zygal Dynamics, Bicester 3361

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Dragon 32 with joysticks and software worth £75, includes Chess and arcade games. Good condition with original box, £170 ono. Tel: 06513 2679 (Aberdeenshire).

Vic20 computer, one month old plus cassette deck, lots of software and books, £130. Basildon (Essex) 284771.

Atari 850 interface, two weeks old £120 ono, National Panasonic music centre £200 ono or swop either for software, Astrochase ǂ16. Basildon (Essex) 284771.

Can any genius interface Spectrum to Silver-Reed EX44 electronic typewriter. Leonard Gaunt, 41 Wellington Road, Hampton, Middx, TW12 1JY. Tel: 01-977 5775.

ITT2020 48K, two double-sided disk drives, modulator, games, utilities (Visicalc etc), Apple graphics modification, £1,000 ono. Tel: Dave, 01-467 2600 X474 during business hours.

Philips G7000 computer plus Race cartridge £45. Also Packman, Space Invaders £10 each, or will swop the lot for Spectrum. Tel: Southampton (0703) 847706.

Sale Oric 1 48K RAM £130. Would swop with 48K Spectrum. Tel: 01-654 7471.

Swop your printer or Spectrum software for up to £130 worth of Scalextric in good condition. All offers (even cash) considered. Tel: Colin 064831337.

TRS80 Model One 16K plus tele printer and software. Offers to Austin, 1 Rosedene Bungalows Methwold Hythe, Thetford, Norfolk. Tel: after 7pm 03666 522.

Swop 165 wines & spirit miniatures, many very rare, worth over £200 for a 16K Vic20 or 48K Spectrum or similar type computer, not ZX81. Tel: Preston 0772 725722, ask for D Robinson.

48K Spectrum with £350 of software (50 games and various utilities) total value new £480, want £240. Tel: 061-437 1876.

Newbrain AD, boxed as new, Beginners Guide, superb computer, 32K RAM, 29K ROM, three months old £210, no offers. Tel: Bristol 603252.

BBC software, Acornsoft's Invaders + Breakout + Dodgems + Snake and Bug Bytes Galaxy Wars. Worth £20, sell for £12. David Lukes 01-977513, after 4pm or at weekends.

Spectrum software to swop. I have over 30 titles on hand. Please phone Robert (0977) 559940 any evening except Monday and Friday.

Oric 1 bargain at £140 plus six cassettes free including Chess, Fortral, Space Invaders. Less than three weeks old. Ring Viren 01-521 5685.

Apple II+ type, larger case, numeric keypad, lower case, two Teal DDs. PAL/SECAM, brand new, £650, service available. Tel: 01-602 8449 evenings.

ZX81 16K RAM, leads, manual, four games, hardly used. £50 also Atari YCS plus 12 cartridges (cost £400) bargain at only £105. Tel: David 01-408 0257 (9-5).

Acorn Atom 4K, manuals, cables, etc £100. Also Olivetti TE300 printer, tape punch/reader, RS232 interface, needs servicing £60. Tel: Crowthorne 771915.

Spectrum software. Do you want to exchange programs? Paul, 31 Bramcote Avenue, St Helens. Tel: 31916.

Wanted ZX81 £20. Not sure if computers are my scene. Want to find out. Tel: 031-657 2530 Edinburgh only.

Archer BBC or ZX81 like swop compare sell archery software have h'caps tournament sort including teams. Brooks, 96 Castlewood Drive, SE9 1NG. Tel: 01-856 7573 evng.

Video Genie 16K, leads, manuals, lightpen inc two tapes; eight arcade games, utilities etc. Value £525, will accept £375 ono. Buyer collects.

Microline 82A dot impact line printer with (serial and parallel I/F) suitable for most computers but can supply Newbrain printer cable £220. Brighton 695351.

Vic20 £65, cassette unit £25, Arfon Expansion Unit with T.V. shelf £45, 15 cassette games £20, six cartridge games £30. Tel: 01-573 8935 after 6pm.

BBC Model B, OS1.2, Wordwise, Medmon, Acornsoft, books, ROM Expansion Board, immaculate condition, boxed, manuals and leads, £450. Tel: John 0432 271589. Buyer collects.

Atari 400/800 software, Zaxxon £25, Ghost Hunter £13, Pyramid of Doom £13, Mini Word Processor £8 (all cassettes). Tel: Maidenhead (0628) 37885.

Commodore 64 micro computer plus Datasette Unit C2N model 1530 new and boxed, unwanted competition prize, fully guaranteed £330. Tel: 0602 382013 Nottingham.

Atari 16K software and ROMs to swop or sell. Also, if any Southport Atari owners want to form a club, phone 0704 38074 after 6pm.

The overwhelming response to PCN's Billboard service is causing delay in publication of some advertisements. To solve this growing backlog and to cover some of the publication costs we are now charging £1.50 for each ad. Every form received at PCN's offices, 62 Oxford Street, London W1A 2HG, must be accompanied by a postal order or cheque for £1.50 made payable to VNU Business Publications.

ZX81 16K (Memopak) plus Haven hardware keyboard, lots of books and mags and some software, £65 ono. Tel: Epsom 26100 ext 293 9-5pm.

Atari VCS with four cartridges £100. Also Mattel Intellivision with four cartridges £100. Mark Quinn, 41 Blackburn Road, Darwen 772786.

Acorn Atom 16K + 28K includes F.P. ROM P.P.Tolbox Timdata 16K RAM card VIA. 5v3amp PSU lots of software, Forth + manual, Snooker, Centipede etc. £180. Tel: 01-953 6311.

16K ZX81 + £60 software including Asteroids, 3D Defender as new. Worth £140, quick sale £65. Tel: (Sheffield) 340440 after 5pm.

Tandy TRS-80 Model III, 18 months old, worth £450, will accept £350. Software available if required. Tel: Bournemouth (0202) 763923.

Mattel Intellivision + 23 cartridges including Tron, Lock 'n' Chase, Pitfall, Utopia, Star Strike, Astrosmash, Boxing etc. Cost today £540+, sell £350. Tel: Leeds 561760.

96K Lynx adapted by Camputers. New baby forces sale. Includes software for printer, other software, Lynx book. Unique offer, £300. Tel: 01-658 0645 evenings & w/e.

Spectrum, cassette and tapes vgc £150 ono. Write or phone Alan Francis, 48 Benland, Peterborough PE3 8EB. Tel: 0733 265503.

Pet 32K new ROM large keyboard vgc £395 incl cassette unit, progs manuals. Tel: Histon (022023) 4787.

Hewlett Packard 41C, card reader, quad memory, games ROM, battery pack. All boxed, excellent condition, ½ new price at £180 ono. Tel: Skegness (0754) 66629.

Dragon software offered in exchange for any books relating to 6800 series micro processor, Dragon or Tandy Color Computer. Tel: 01-8211710 after 6pm.

Bargain! Excellent condition ZX81+16K, professional keyboard, over 20 games including Mazogs, Flight Simulation, Trader, Defender, Chess and more. Worth £200, accept £80. Tel: 254 5952. Free delivery.

Lynx 48K complete with leads, manual, book, user mag, software, Numerons, Golf, Election Analyst, value £250 accept £200. Tel: B Smith, Midsomer Norton (Avon) 0761-413727.

Tandy Color Computer, 16K manual and other books, magazines, cassette leads, six months old, £80. Tel: Southampton 694507 evenings.

Oric-1, 16K RAM, boxed, as new, three weeks old, worth £129, accept £105 for quick sale (no offers). Tel: 01-959 1513 evenings/weekends.

Apple II 48K, two disk drives, monitor, Epson printer, Visicalc and floppy disks, all nearly new, £1,400 ono. Worth £2,000. Tel: Uxbridge 35335 71315.

48K Spectrum, + manuals, leads with Kempston joystick, cassette unit, plenty of software, books and magazines £130. 20 Bailey Street, Liverpool. Tel: 051-709 3525 evenings and weekends (John).

Atari 400 16K, Program Recorder (both under guarantee), Basic, manuals, joysticks, Star Raiders, Preppie, Airstrike, membership of software library, £200. Tel: (04252) 72271 (Highcliffe).

Sinclair ZX81 plus 16K RAM, hardly used, must sell immediately. Plus software cassettes, accept £60. Rehan Kaleem 01-540 7255 after 6pm, or leave message.

Oric-1 48K with Zodiac adventure cassette and books for sale £150. Tel: Braintree (0376) 44712.

Microtan 65, Basic, fully expanded Tanex, 8K RAM, Lower case, X bug, Assembler, graphics, Toolkit Eprom, parallel/serial I/O, 19in rack PSU ASCII keyboard plus software £190 ono. Tel: (0344) 84295.

Zaxxon cassette for Atari 400/800 also Savage Island, The Count, Defender, Asteroids ROM sell or swop. Tel: Mick 789 7085 Wimbledon, London.

TI99/4A, one month old, boxed, hardly used, including present promotion kit (joysticks, Connect 4). £125 ono. Clive Newton, Plot 90 Brookside, Coed Eva, Cwmbran, Gwent.

Spectrum 16K, manuals, progs, Whist, Chess, Horizons, little used £79. Hutchings 0380 3341.

View foe sale £49 ono, bargain, virtually brand new, Fawdry, 5 Elmete Walk, Leeds LS8 2LB. Tel: 0532 654055 (evenings).

Spectrum Downsway 32K expansion RAM, guaranteed till end August. Cost £42, accept £32. Tel: Reading 696544.

Vic20 + 16K, CZN cassette, joystick, Reference Guide, Programmers Aid. Four software cartridges + tapes, all in mint condition, worth £400 sell for £200. Tel: 061-736 1534 after 6pm.

Vic20 C2N, storeboard 8K, 3K, Vickit3(HRG) MCM, Programmers Reference Guide, dustcovers, lots of software, Owners Manual, cost over £380, accept £250. Tel: 0782 620657.

TRS 80 Mod1 L2 software, books, sound, spare cassettes, unwanted present, worth over £270, only four months, a bargain at £165 ono. Tel: Paul, Scunthorpe (0724) 782548.

ZX81 16K, keyboard, leads, £130 worth of new software, £90 worth of new books, excellent condition, worth £325, sell bargain £115 ono Tel: Cardiff (0222) 372892 (evenings). Require quick sale.

Acorn Atom 12K ROM 12K RAM includes, brand new PSU + all leads, also couple books, exc cond, all for only £99, (quick sale). Tel: Manchester 061-420 2769.

Atari VCS + nine cartridges, Star Raiders, Warlords, Space Invaders + Pinball etc. Complete with paddles, joysticks. Cost well over £300, sell for £150. Tel: 061-428 2769.

Unexpanded ZX81 £35. Tel: (03954) 3384 (Devon).

TRS80 Model 1 Level 2 + VDU + cassette unit + over 40 programs + high res + amplifier for sound. Total cost over £1,000, selling for £390. Tel: Maidenhead 73707.

Atari software, Protector, £12, Tanktics, £8.50, Golden Voyage £8.50, Eastern Front £12, Lords of Karna £6.50, Le stick joystick £12. Originals Southend (0702) 559455 (5pm).

Wanted, Nascom disk system or Micropolis drives (no controller board required) or cheap CP/M computerbridge. 363 Kennington Lane, Vauxhall, London SE11.

TRS90 Mod1 Lev2 green monitor cassette, quickprinter, leads, manuals, editor, Assembler, books, tapes, including Jumbo, Microsoft Lev3, Arcade games etc. £250. R Pepper, 28 Lumley Avenue, Skegness, Lincs.

Philips G7000 five cartridges, Music, Laser Wars, Computer Golf, Ice Hockey, Soccer, worth £165, sell for £110 or swop for Spectrum and software. Tel: Coventry (0203) 33 3926.

Wanted, £150 for my 12K+12K Atom with leads, manuals and PSU, also wanted, £140 for my Seikosha GP80A with paper, cable and manual, bargains. Tel: (0472) 48531, after 6pm.

Chess Challenger Nine boxed, 18 month guarantee, modular capability, excellent condition £110 ono. (Save £50+ on RRP). Manual, extras. Contact Stuart, Birmingham (021) 421 6178 (after 6pm).

ZX Spectrum system, 16K ZX Spectrum, cassette player, ZX printer, all necessary leads and documentation, complete with guarantee. Bought for £180 new. £140 ono. Tel: 01-455 5589 ask for Nick.

Printer. ICL terminal printer 110-1200 baud, 10-120 CPS, serial interface, DIN or integral roll, with cable. Very good condition, £120 ono. Tel: 051-644 6568 (Merseyside).

Spectrum 48K £110 or swop for very good condition Vic20 plus cassette recorder. Call anytime 25 Broughton Road, Saffron Lane Estate, Leicester.

MZ80A. Why pay £549 new? Mine is for sale at only £375 including carriage. Perfect condition, also six software tapes including Sharp Basic. P White, 52 Abbotswood, Yate, Avon.

Personal Computer World complete run Vol.1 No.1 to Vol.3 No.12 perfect condition in two binders. Many O/P. Offers to Mac 02756-2120.

Vic20 8K RAM pack for sale, £25 ono, also Bug Byte Asteroids cassette game, £4 and Programmers Aid cartridge £25 ono. Tel: Wendover (0296) 624045 after 5pm.

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Atari VGS three month old, boxed as new, including Combat, Missile Command £70. Tel: 01-561 5812.

ZX81 (16K) Kempston keyboard, Zonx sound unit + Spectrum extension board + £20 of software, worth £180, offers over £125. Tel: S Kenton 660-6007, first come first served, manual etc.

Lynx 48, leads, manual, cassettes, magazines + first issue of Lynx User. One year guarantee, excellent condition £195 ono. Tel: 727 3606, Jason, after 5pm.

Atari cassette games sell (£8) or swop for other games, Necromancer (new K32) Zaxxon, Airstrike, Preppie, Shamus, Chicken, more. After 4pm. Tel: 01-203 4545.

48K ZX Spectrum, weeks old, loads of software and mags worth £350, sell for only £180, or exchange for BBC A/B, software includes Hobbit, Chess, Penetrator etc. Tel: 01-590 8301.

Atari software: Protector £12, Tanktics £8.50, Golden Voyage £8.50, Eastern Front £12, Lords of Karma £6.50, Le Stick joystick £12, originals. Tel: Southend (0702) 559455 (5pm).

16K Spectrum, excellent condition £70 ono. Tel: Mervyn, Penzance 5569. 10 Trannack Ter Treneer Est, Penzance, Cornwall TR18 3QA.

Wanted, Zx81 16K Panda Expansion £10. John Sinnott, 4 Rutland Street, Grangetown, Cardiff CF1 7TD.

Wanted Commodore 4022P printer or equivalent for around £100. Tel: Kingswinford 271183 please.

For sale, radio controlled car, two or four wheel drive, fully digital proportional, worth £70, selling for £35 ono, as new. Tel: 01-504 0565 (evenings).

Atari VCS five months old, boxed with game controllers and Combat, Starmaster Adventure, E.T., Basketball and raiders of the Lost Ark cartridges, perfect condition, £135. Tel: Auchtermuchty 8837.

Genie, TRS80 16K Level 2. Jumbo, Flight Simulator program with manual, on cassette, excellent program, £12. Perfect condition. Tel: Leicester 856885.

Wanted, tape recorder that will save on Spectrum. Tel: Bradford 593897.

100 Pet/CBM games including Chess, Breakout, Star Trek, The Valley and World Cup Manager. Tel: Southend (0702) 588601 after 5pm.

Intellivision cartridges for Scoop, Skiing and Star Strike, any other cartridge wanted but especially Tron, Sub Hunt or Utopia. Tel: Bournemouth (0202) 24036.

Wanted: volume 1, issue 1, of Your Computer (June/July 1981), must be in mint condition. Tel: Lincoln (0522) 680824.

Spectrum software, Meteor Storm, Space Intruders, Ground Attack, £3.50 each. Winged Avenger, Arcade Pack £3 each. Tel: (08675) 6921 (Kidlington) evenings only.

Oric Flight £6.75, Oric-1 48K model £160 (about two months old). Tel: Bournemouth 579561 after 6pm.

Apple II Europlus 48K TV modulator, disk drive and controller, DOS toolkit plus manuals, £800. Tel: 051-734 2054 after six.

Vic20 software for sale, Omega Race £17 and Skramble! £4, both boxed. Tel: Buckland St. Mary 213.

Rockwell Aim65 Micro with 20-column display and printer onboard, ideal for 6502 training. Exceptional documentation, all unused £165. Tel: Egham 33500.

Acorn Atom 12K + 12K toolbox, 6522 VIA, Atom Magic Manual, £90 of software, only £100. Tel: 0482 571227. Also ZX Spectrum £45, Hull area.

Swop Vic20 software for cartridges or cassettes, also wanted Commodore 3K or 8K RAM pack. Tel: 01-574 4122.

Addict must have printer for BBC B, Epson, Seikosha or similar, have pity! 01-451 2025 after 6 if price is sensible.

Apple disk drive with controller plus Apple system ITT2020 48K and software worth over £1,000, bargain at £500 ono (may split). Tel: Bristol 741672.

Bored Acorn Atom owner wants to swop programs and ideas. Mr Cobb, 27 Lansdowne Road, Seven Kings, Ilford, Essex IG3 8NE.

PET 4032, toolkit, cassette, 40 games programs, manuals, all in excellent condition, £350 ovno. Beverley, Shore Lane, Bishops Waltham, Hants. Tel: Bishops Waltham 4068.

Vic20 C2N player, Arfon expansion board, joystick, assembly language monitor, 8K static RAM, games cartridges, programmers, manual, other books, £225 ono. Tel: Coventry 303476.

Dragon 32 plus cartridges and tape, software inc Cyrus Chess, Invaders etc, in original boxes, offers over £140. Disabled clergyman needs to sell. Tel:01-340 9423.

Acorn Atom, as new, 12K RAM, floating point ROM, toolbox ROM, books and software including Forth, chess, Adventure, bargain, £160. Tel: (0602) 392554.

ZX81, 16K, dkTronics keyboard, key bleeper, dkTronics toolkit, dkTronics graphic board, over 30 games etc, bought BBC, offers. Tel: Adlington 481570 after 6pm (Lancashire).

Atari VCS plus Combat Space Invaders, Defender, Chess, Dodgem and Air Sea Battle, complete with joysticks and paddles, £115. Tel: Wakefield 262691 after 6pm.

ZX81 16K File 60 keyboard +400K of software, worth £150, sell for £55. Tel: (0634) 366332 (Medway).

Vic20 cartridge to sell including Sargon 2, Star Battle, Alien, Road Race, Gorf, Mole Attack, £11 to £14 each, also cassettes for sale, including Anirog, Rabbit, Hamasoft, Romik. Tel: 01-574 4122.

Philips G7000, 7 cartridges, £90, including Pacman, Freedom Fighters and Satellite Attack. Tel: Morecambe 414274 after 4.30. Simon Rudd, 11 Lonsdale Road, Morecambe.

ZX81 32K, dkTronic keyboard, all manuals and leads, chess game, worth £150, will sell for incredible £70! Byron, 01-736 3898.

Apple II 48K with 2 disk drives, colour, integer/Applesoft, Epson printer interface, joystick, over £250 software, £750. Tel: Chorleywood 2680 evenings.

Lynx 48K, three months old, still boxed, also cassette recorder and Cheese Chase game, £200 ono. Tel: 061 707 3716 after 6.30 pm.

Wanted Atari disk drive. Tel: Bournemouth (0202) 512538 after 7pm.

Acorn Atom 12K + 12K, PSU, leads, 6522VIA, manuals, I/O control board, software, sound amplifier, worth £250+, sell for £160. Tel: Crayford 529436.

ZX81 Penfriend wanted to swop program and thoughts, between 10-17 years old. Sara Hill, 26 Hamilton Road, Wimbledon, SW19, 01-542 5767.

16K ZX81 Fhc-60 keyboard, software keyboard, sounder and hi-res graphics, leads, boxed and eight months' guarantee, £60 for quick sale, consider offers. Tel: 01-603 5644.

ZX81 plus Sinclair 16K RAM pack over £40 of software including Defender, Space Raiders and Chess, plus all leads, boxed, four months old, sell for £70 ono. Tel: (0700) 2346.

Sinclair ZX81+16K, complete with manual, power supply, leads, nine different games, four months old, sell for £75. Tel: (0700) 2346 after 5pm.

Commodore 64 software for sale. Hitch Hikers Guide to Galaxy Adventure, £10; arcade games, Mangrove, Tank Atak, £7 each, excellent condition. Tel: Portishead (0272) 848033.

Spectrum software for sale, Hobbit, Penetrator, Flight Simulation, Arcadia, Timegate, Schizoids, 30-Tunnel etc. Free digital penwatch or watch with first tape sold. Tel: 061 881 3651 (Tony).

Wildfire Electronic Pinball game, cost £35, sell £20 or swop for 16K module for ZX81. Tel: 01-459 6326, ask for Stav Sherez.

Vic 20 + cassette + 16K RAM pack, Joystick, Sargon, Alien game cartridges, Programmers' Reference Guide. Introduction to Basic 1, six months old, mint condition, £130. Tel: 01-647 0671.

TRS80 Level II + VDU + cassette + over 135 games and utilities with manuals, £225 ono. Leeds (0532) 587202.

Intellivision five months old, hardly used plus five games £180, sell to buy BBC (B). 01-889 9882 eves.

Osi Challengerip 16K steel cased, including disc controllers, G10 board, Cegmon Basic 5 enhanced screen software includes M/C word processor, Exmon £200. Mobberley 3362, Cheshire.

Vic20 software for sale, Adventureland £17, Voodoo Castle, £17. Vic Panic £5, Vic Cesmaids £5, Amor £5. Ledbury 3807.

BBC software for sale, all originals, Acornsoft A&F Level 9, Bug-Byte M&P, Program Power Digital Fantasia BBC Soft half cost price. 061225 2769.

Free! C2N cassette unit, eight blank cassettes, program book and joystick if you buy my Commodore 64 for only £320, one month old, mint condition. (0282) 25011 ext 443, day only (Lancs).

Oric-1 48K boxed as new, only £150, I.N. Hunter, 74 Elmsley Street, Preston, Lancs PR2 7XE.

Atari 400 software, original tapes, some disks and ROMs, half price. Ashtead (Surrey) 76933.

Casio MT-31 keyboard complete with manual and carry case worth £160, sell for £115. Post offers, no money, to Paul Houbart, 12 Cambridge Rd, Southport, Merseyside PR9 9NG.

ZX 81 1K, with power supply, manual, leads, games tape with games, and various magazines, still under guarantee, excellent condition, bargain — £34. Tel 0851 4475 (after 6pm).

Genie I 16K RAM 12K ROM, plus software and books valued at over £150, all for £170. Saundersfoot 813248 (evenings).

Atari VgS, + four cartridges, Space Invaders, Chess, Combat, Street Racer with joysticks, paddles, very good condition, £100 ono. Tel: (01) 888 3120 after 6pm.

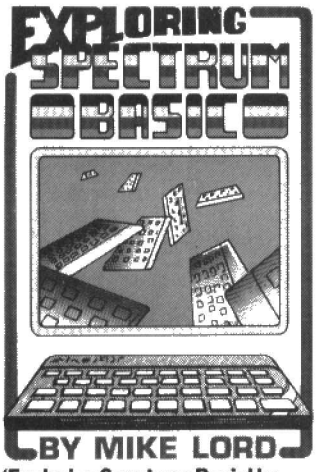
Wanted BBC Model B, maximum wanted to pay £300 with software. Tel: Bognor Regis 0243 828111 (Monday to Friday).

Atari Video Computer System including Combat and Pacman cartridges, still boxed and under guarantee, an excellent bargain at £85. Tel: Wythenshaw 061-436 5683.

Atari 400 16K plus Star Raiders and one Joystick, all in excellent condition, also sound and graphics book, sell together for £130. Tel: Welwyn Garden (07073) 38338 evenings.

READERS' BUY & SELL FORM

Billboard is *PCN*'s micro marketplace. Whether you are buying, selling, or swopping secondhand goods, just fill in the form up to a maximum of 24 words, including your name, address or full telephone number and send it with a cheque or postal order for £1.50 payable to VNU Business Publications, to **Billboard, Personal Computer News, 62 Oxford Street, London W1A 2HG.** But remember, this service is not for commercial advertisements; we will not include ads from companies large or small, or from anyone carrying on a profit-making business. Also, we cannot guarantee to place ads in specific issues — it's first come, first served. No reprints either unless you send in another form. Please write clearly putting only one word in each box, and remember to include your **full address and telephone number,** even if you don't want them in the ad.



'Exploring Spectrum Basic' by Mike Lord, published by Timedata at £4.95 (paperback, 191 pages).

Down at the British Library there must be consternation over the structural soundness of the shelves housing books of the 'Beginner's Guide to the X Micro' variety. *Exploring Spectrum Basic* slips neatly into this category, and fortunately is one of the better of the genre.

It starts off in the now traditional 'what is a computer?' mode, but this is thankfully clear and concise, with little of the gosh-woweries we have come to expect from books of this type. Mr Lord then takes us through the terms and commands encountered when using the Spectrum — the explanations here are particularly detailed, and presuppose no prior knowledge.

The next step is an introduction to programming. Mr Lord produces annotated listings of programs for graphics, games and practical purposes, interspersed with technical information.

The programs themselves are by and large original. You get the ubiquitous Biorhythms and Moon Landing — although I looked in vain for Hangman — but what about Elephants Dropping and Vogon Haiku Hacker? Clearly there is a fertile imagination at work here.

Haiku Hacker, on the other hand, writes meaningless four-line verses in the Haiku style.

But with the number of program listings available nowadays, one of the most useful sections of the book will be the guide to other Basics. This deals with the Spectrum equivalents of commands used by other machines, and will be a handy aid for would-be converters.

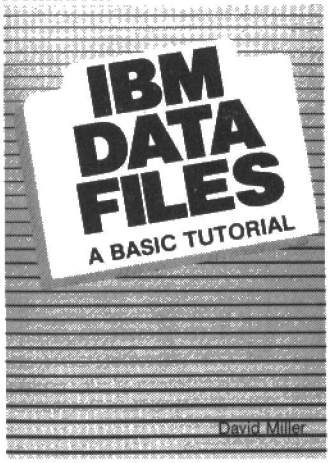
My only grouse is the fact that the book has no index. **JL**

'IBM Data Files — A Basic Tutorial' by David Miller, published by Reston (a subsidiary of Prentice Hall) at £12.75 (paperback, 260 pages).

David Miller approaches the IBM PC's filing system almost apologetically. Disclaimers abound in the early pages and the author qualifies what an author can hope to achieve at regular intervals. Mr Miller understands humility — there are far too many arrogant pedagogues writing books in this business.

He understands the IBM PC as well, and explains it with enthusiasm. It takes considerable enthusiasm to open a chapter on 'Appending Sequential Files' with the words: 'Now the fun begins.'

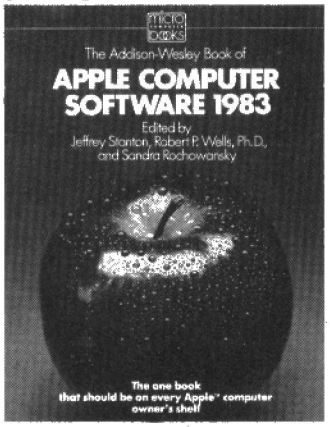
The sequence in which he unpeels the layers of the PC filing system is neat and logical. He explains the concept of a file in a discussion of file types, gives program files a separate chapter, and deals with data files in detail. Creating, appending, displaying and correcting sequential files all merit their own chapters, and he outlines further sequential file techniques and a standard format for transferring file information.



His introduction to random access files is gentle in the extreme — there are still some aspects of the ex-mainframe programmer's dinosaur that inspire fear in micro users. In the closing chapters Mr Miller explains how to plan and program a filing system.

The text is liberally supplemented by coded examples and complete programs, all of which are available on a disk from the publisher. And each chapter closes with a question-and-answer section to burn the lessons of the chapter on to your own personal ROM — but this is of doubtful value since the answers to the questions are on the facing page.

This is an excellent book which fulfills its purpose in a pleasing fashion. **DG**



'Apple Computer Software 1983' edited by Jeffrey Stanton, Robert P Wells and Sandra Rochowansky, published by Addison-Wesley (01-631 1636) at £13.45 (paperback, 490 pages).

As may be guessed from the title, the *Addison-Wesley Book of Apple Computer Software 1983* is a directory of programs available for the Apple range of micros. Well, the II, II+, IIe and III, anyway.

There's a lot of software available for these machines. This book is fat — almost as big as the Yellow Pages for Central London. And there are more than 500 entries.

It's broken up into eight sections: business, education, utility programs and games & entertainment for the software, with a hardware (peripherals) section, an introduction and an index and — very useful — a list of software houses.

Each major section is further divided and this format makes it easy to find a review of each program by looking for either a specific title or program type.

An entry consists of three parts — a list of details such as title, publisher, language, hardware requirement, department (class of program), price in US dollars, availability on a scale of 1 to 10, and whether disk or tape.

Next comes a set of ratings from A+ to D−, and lastly the biggest part, a review complete with black-and-white screenshots, if relevant.

The reviews are generally well-written and, knowing many of the programs myself, I felt the reviewers thought much the same as I did.

Since this is a compilation of only the most popular programs, which must also mean the ones the editors could get hold of, it is by no means exhaustive — there are reputed to be more than 16,000 programs published for the Apple II and II+ alone, let alone the public domain stuff, and that doesn't include all the CP/M programs available, nor much p-System.

So who's going to compile the definitive directory, and how big is it going to be? **RK**

'20 Simple Electronic Projects for the ZX81 and Spectrum' by Stephen Adams published by Interface at £6.45 (paperback, 110 pages).

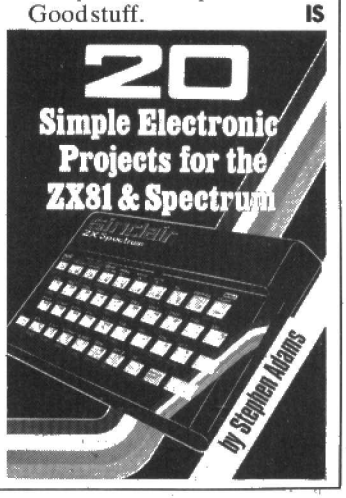
This book attempts to put the DIY back into hobby computing. In the good old days (five years ago) solder, iron and veroboard were an essential part of every hobbyist's kit. There is undoubtedly still a substantial residue of 'old-school' hobbyists about (and probably a few new ones) who would welcome these projects.

The inexperienced need not be deterred. The projects are designed to provide the cheapest and easiest devices to get information in and out of a computer or into a usable form. Projects include an analogue-to-digital converter, a numeric keypad, a mains supply filter, standby power supply and a light-pen.

Nothing is taken for granted. The first few pages describe circuit diagrams, soldering and porting. Each chapter is well explained and includes a circuit diagram of each of the hardware projects.

I found the style a little matter-of-fact (Frank and Ernest strike again) but this is probably all to the good — who wants peppy prose when you're holding a soldering iron in one hand, stabilising a veroboard with the other and holding a book open with a spare elbow?

Good stuff. **IS**



Achtung, was is das, etc, etc.

Vielen danke to the observant reader who sent us a page from the June 23rd issue of *Stern*.

The advert is for Commodore equipment sold by a company called Vobis which says that 'fur unter 3000 Mark gibt es jetz eine komplette Datenverabeitungsanlage mit Magnetscheibenspeicher und Schnelldrucker'.

Now if you think that sounds cheap you'd be right. At £1 = DM3,85 the 'Schnelldrucker (Matrixdrucker mit parallelschnittatelle) von Shinwa' costs £337 (DM1.298), and the 'Aspassung (interface) und Kabel fur CBM 64 o. VC 20' costs (DM198).

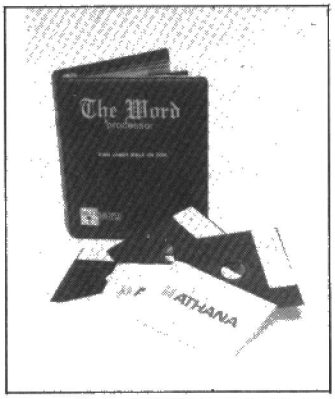
The CBM 64 was apparently DM1098 — but has now dropped to DM858. (£222).

And the VC1541 'Magnetscheibenspeicher (Floppy Disc)' costs DM848 — (£220).

Putting the whole lot together Vobis will sell the 64, disk drive, ten disks and printer for DM2996. That's £778.

Vobis's telephone number is 010 49 241 50 00 81. Alternatively, Commodore is on 0753 74111.

Machine worship



APL stands for A Programming Language. It started life as TPL, The Programming Language, but this was felt to be too prententious. Can history be repeating itself with The Word Processor? Will it become just A Word Processor from Pete and Pam? No — The Word Processor is nothing less than the King James Bible on disk. The Word in this package is what there was in the beginning, and will always be. But getting expensive — £149 in this version.

NEXT WEEK

- **Exclusive Pro-Test: Seikosha's GP700A colour printer**
- **Pet Payroll: Bonus! adds sick pay to wage calculations**
- **DIY Bare Board: the naked truth about Rade's DIY micro**
- **Music in the air: Micropaedia tips for Vic, Atari, BBC and Apple**
- **Tape v Disk: how does Currah rank?**

SYNTAX ERRORS

We know Texans think big, but we can't blame the southerners for the over-large program lines which appeared in Micropaedia Sound last week in an article on the T199/4A. So, let's try again!

The first example should read:
10 FOR F=260 TO 2500

The second example should be:
10 FOR F=200 TO 2500
20 CALL SOUND (-1,F,5)

In the third example lines 20 and 30 should read:
20 LET L=110
30 IF H=110 OR L=25000 THEN STOP.

In Sounding Out the Vic, *PCN Micropaedia issue 17,* program 1 lost a line. 145 should be POKE NO, INT(RND(1)*40)+220. Sorry!

PCN DATELINES

PCN Datelines keeps you in touch with up-coming events. Make sure you enter them in your diary.

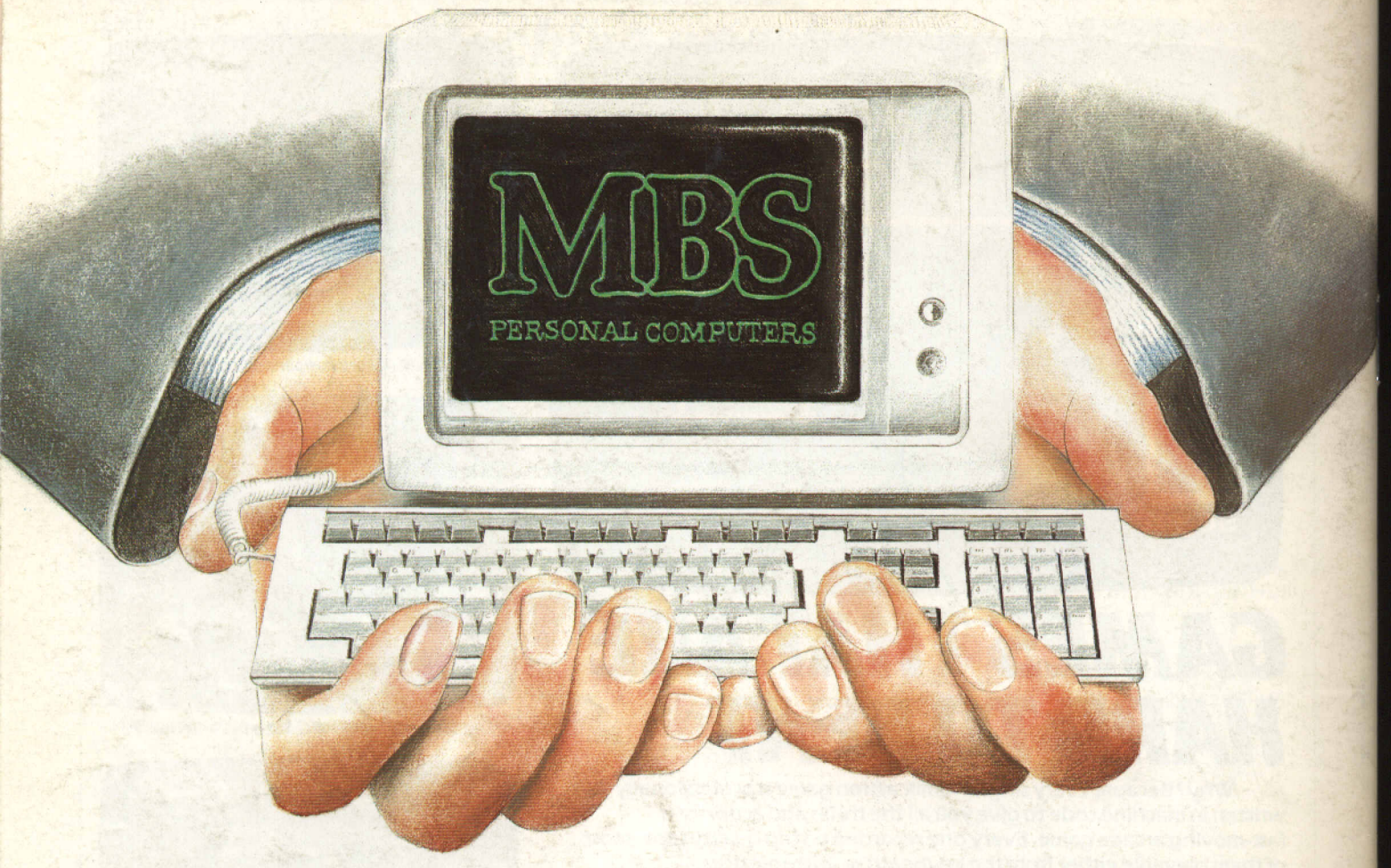
Organisers who would like details of coming events included in PCN Datelines should send the information at least one month before the event. Write to PCN Datelines, Personal Computer News, 62 Oxford Street, London W1A 2HG.

UK EVENTS

Event	Dates	Venue	Organisers
IBM Users Conference & Exhibition	July 12-14	Wembley Conference Centre	Online Conferences Ltd, 09274 28211
Computers in Personnel	July 12-14	Royal Lancaster Hotel, London	Peter Mirrington Exhibitions, 0277 232030
8th ZX Microfair	August 20	Alexandra Palace, London	Mike Johnstone, 01-801 9172
Acorn User Exhibition	August 25-18	Cunard International Hotel, London	Computer Marketplace Ltd, 01-930 1612
Computer Open Day	September 1	Draganora Hotel, Leeds	Tony Kaminiski, Couchmead Communications Ltd, 01-778 1102
Home Entertainment Show	Sep 17-25	Olympia, London	Montbuild Ltd, 01-486 1951
Computer Open Day Exhibition	September 22	Central Hotel, Glasgow	Couchmead Communications Ltd, 01-778 1102
Microcomputers in Business	Sep 27-29	Warwick University, Coventry	Peter Bubb, 01-892 4422
Personal Computer World Show	Sep 29-Oct 2	Barbican Centre, London	Montbuild Ltd, 01-486 1951
Computer Fair	Oct 2	The Sir Frederic Osborn School, Welwyn Garden City	R Brown Welwyn Garden City 23367

OVERSEAS

Event	Dates	Venue	Organisers
International Micro Computer Exhibition	Aug 2-5	Kuala Lumpur, Malaysia	Conference & Exhibition Management Services SDN BHD, 9-A Jalan SS24/8 Taman Megah, Petaling Jaya, Selangor
National Computer Business & Office Systems	Aug 16-19	Auckland, New Zealand	Trade & Industrial Exhibitions, 12 Heather Street, Parnell, PO Box 9682, Auckland
Personal Computers & Office Automation Systems Exhibition	Sep 5-8	Amsterdam, The Netherlands	RAI Gebouw BV, Europaplein 2, 1078 GZ, Amsterdam
Australian Computer Exhibition	Sep 13-16	Melbourne, Australia	Riddell Exhibition Promotions PTY Ltd, 166 Albert Road, South Melbourne, Vic 3205
International Peripheral Equipment & Software Exposition	Sep 13-15	Moscone Centre, Anaheim, USA	Cahners Exposition Group SA, 0483 38085



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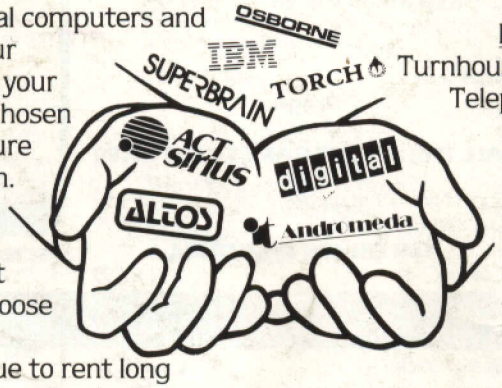

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